THE ENGINEERING RECORD
PUBLISHED WEEKLY BY THE
McGraw Publishing Company
MAIN OFFICES:
114 LIBERTY STREET, NEW YORK.
BRANCH OFFICES:
PHILADELPHIA: 929 Chestnut Street.
CHICAGO: 1140 Monadnock Block.
CLEVELAND: Cuyahoga Building.
LONDON OFFICE: Hastings House, Norfolk St., Strand.

SUBSCRIPTION RATES:
United States, Canada, Cuba and Mexico....$3.00 a year.
Foreign subscription .... 6.00 a year.
25 shillings. 25 marks. 31 francs.
Foreign subscriptions may be sent to our London office.

NOTICE TO ADVERTISERS.

Change in advertisements intended for a particular issue should reach the office of THE ENGINEERING RECORD by 10 A. M. Monday of the week of issue. New advertisements can be received up to noon of Wednesday of the week of issue.

NOTICE TO SUBSCRIBERS.

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of THE ENGINEERING RECORD.

CHANGE OF ADDRESS.—The old address should be given as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—After July 1, 1905, no copies will be kept on sale beyond fifteen months from date of issue, except in bound volumes.

Entered at the New York Post-Office as Second Class mail matter.

Copyright, 1905, by the McGraw Publishing Co.

Of this issue of THE ENGINEERING RECORD 12,000 copies are printed. Total circulation to date 295,500 copies.

TABLE OF LEADING ARTICLES.

Lap Joints and Boiler Explosions................. 669
Hydraulic Power from City Water Mains.......... 669
Engineers and Architects' Plans.................. 670
Range and Thoroughness in Technical Studies...... 670
The Highway Bridge over the Wabash River at Terre Haute. (Illustrated.) 672
The Formation of Anchor Ice...................... 675
The 72,000,000-Gal. Sewage Pumping Engine at Dorchester. 676
A Notable Engine Test............................ 677
The Accident in the Gunnison Tunnel. (Illustrated.) 679
New York Subway Ventilation...................... 679
Replacing a Howe Truss Span with Plate Girders. (Illustrated.) 681
Grand River Reinforced Concrete Bridge, Grand Rapids, Mich. 681
Fire Protecting Coverings for Window and Door Openings. 682
Mechanical Filter at Binghamton, N. Y. (Illustrated.) 683
Fire Protection at the Worthington Works. (Illustrated.) 684
Pipe Foundry Practice 685
The Morris Canal Crossing of the Lackawanna R. R. (Illustrated.) 686
Power Plant Supervision and Accounting.......... 687
The Candler Building, Atlanta. (Illustrated.).... 688
Heating and Ventilating System of the Majestic Theatre, Boston, Mass. (Illustrated.) 690
Purchased Electric Power in Factories............ 692
Electrically-Driven Centrifugal Pumps for Elevator Service. 692
Book Notes. 693
Local Branches of the American Society of Civil Engineers. 694
Registration of Architects....................... 694

Lap Joints and Boiler Explosions.

This journal has so frequently expressed its opinion that the most dangerous features in engineering works are generally the minor details, that it is hardly necessary to elaborate on the subject generally at this time. A specific instance of this truth is afforded, however, by the final report on an investigation of the Brockton boiler explosion made a little while ago by the Hartford Steam Boiler Inspection & Insurance Co. The preliminary report of the company on this very disastrous accident was printed in the Current News Supplement of this journal on April 1, and it was then stated that the explosion was probably caused by a lap-joint crack. The boiler was frequently and carefully examined, yet it blew up on the day after it was placed in service, after an idle period, while it was carrying only its regular pressure of 80 lb. It was 6 ft. in diameter and 17 ft. long, and built of ⅜-in. firebox steel made by Carnegie, Phipps & Co. The thorough examination made by the company's experts has led them to confirm their earlier statement of the cause of the explosion, and as the lap joint is used in about seven-eighths of the boilers now in service it is manifest that it is a very important detail.

It is well known that in the passage of a plate through the bending rolls for the purpose of giving it the proper form for a boiler, a great deal of strain in the metal is inevitably caused. If this were not the case the sheet would not be curved after the process, for steel is sufficiently elastic to resume its original form after being subjected to large stresses. Another fact that can be observed at any set of bending rolls is the lack of uniform curvature in a solid sheet at those edges where it enters and leaves the rolls. If these edges have been punched, the plate is often bent considerably along one of the lines of rivet holes. It is these edges which are brought together and riveted, and it is often necessary to force them together by sledging or its equivalent. In the case of a lap joint, the extra strains coming on the metal do not cease with the completion of the manufacturing processes, for when the boiler is put in service the tension in the two plates has a tendency to twist the joint in a way perfectly apparent to the reader who will make a sketch of such a joint. For all these reasons it is manifest that the steel used in a boiler must be selected with full regard for its ability to withstand these special stresses due to the use of the lap joint, and the necessity for marked ductility in the plates, particularly those of considerable thickness for shells of small diameter, needs no demonstration.

Even with the best of care and materials a dangerous defect is liable to occur in the lap joint, which has received the name of the lap-joint crack. It was such a defect that caused the loss of 58 lives, injuries to 117 more people and the destruction of property valued at about a quarter of a million dollars. With such facts before one it is almost criminal to look upon the design of boiler details other than with extremely critical eyes, or to fail to study this peculiar class of cracks.

The lap-joint crack is defined by the Hartford company as a fracture of one of the plates, which follows the general course of the joint under the extreme edges of the rivet heads in such a position as to be entirely covered by the projecting lap of the unaffected plate. They have been discovered many times in this country and abroad, and in Great Britain some of the leading authorities on boiler construction have drawn attention specifically to their dangerous nature. The main fact to observe is that the crack, no matter which plate it may be in, always starts from that face of the affected plate which is in contact with the overlapping plate, progressing into the metal more and more deeply until the boiler is weakened perhaps to the point of explosion. It cannot be seen from either the outside or inside of the shell until it has penetrated clear through the metal or has run into a rivet hole, so that its presence is shown by escaping steam or minute cracks. Before such indications can be observed the boiler may have reached a condition of extreme danger. The inspectors of the Hartford company have found examples of such cracks running for long distances along the joint without perforating the metal at any point, and Mr. Fletcher, of the Manchester Steam Users' Association, has made a somewhat similar assertion concerning an examination he once made.

This danger has been so well known that some boiler designers and makers are urging the passage of legislation forbidding the use of boilers having lap joints. They assert that no boiler having butt joints has ever exploded, but neglect to add that the number of these boilers is very small compared with the other type. It is a question whether such a legal prohibition is advisable. A well-made lap joint in a boiler constructed of suitable steel is not essentially dangerous, although the result is by no means so good as a boiler of equal quality with butt joints. Instead of prohibiting the use of the lap joint it would be wiser for the present to hedge its use about with so many precautions that it will become as safe as such construction can be made.

Hydraulic Power from City Water Mains.

The invention of new methods and appliances for utilizing gas and electricity, combined with subsequent systematic and clever advertising by gas and electric companies, has resulted in so educating the public to the habit of using their products, that the once-dreaded competition between the two is no longer greatly feared by either. On the contrary, each often has more business now than it would have enjoyed if it had continued to have its field to itself, and if there had been no incentive to advertise. The lesson taught by the experience of the gas and electric companies ought to cause the business manager of any water works plant to cast about for some method of creating a legitimate and profitable demand for more water.

The utilization of the water in the mains for power purposes would naturally suggest itself as an aid to sales, and it may be of interest to see why there has been no general development of this line of business. Hydraulic elevators have, it is true, been in common use for many years, and a large number have been operated by water drawn directly from city mains in locations where the pressure exceeded 60 or 70 lb. These elevators proved safe, noiseless and exceedingly satisfactory to the consumer in so far as their mechanical operation was concerned. They require little care and attention, and are available for service at any hour of the day or night. By means of a simple counter actuated by the motion of the piston, the quantity of water used can be arrived at without the expense of several hundred dollars for a large meter. Their use enabled hotels and business houses of medium size to shut down their boiler plants during the summer months, and in many cases they proved so much better for the consumer than anything else that was available, prior to the introduction of the electric elevator, that he could well afford to pay for the water used in their operation a rate that would yield a fair profit to the water purveyor. But the hydraulic elevator is not without its drawbacks, the worst of all, from the standpoint of the water works man, being the water hammer produced in the mains by the sudden opening and closing of the elevator valves. In some cases water works superintendents have discontinued supplying water to elevators for this reason alone.

For a time the operation of small motors driving coffee grinders, spice mills, meat choppers, sausage machines, or the like, and of water-driven office fans, offered an attractive field for the utilization of any surplus power at the disposal of the water works man; but here again the electric motor appeared as an active and finally victorious competitor. The reason for the success of the new power lies principally in its relatively low cost. Leaving gravity water supplies out of the question, the first cost of a water works plant is very much greater than that of an electric plant of equal horse-power. The cost of the boilers may be assumed to be the same for the two plants, and the cost of the pumping engines, complete with the usual pump-pit and the expensive suction and discharge pipes located therein, would probably be at least equal to that of the engine, generator and switchboard of the electric plant. The cost of the water motor installed complete with its supply pipe from the main, and waste pipe to the sewer, is not greatly different from that of an electric motor of equal power.

Sometimes the water supplied to the city mains is filtered, sometimes it is drawn from wells, and sometimes it is taken, unfiltered, from a stream or lake.

In any case there must be a large expenditure, whether for filtration plant and connections, wells and connections; intake pipe, water rights, or lands to protect the purity of the water supply, which will have no counterpart in the items making up the cost of an electric power plant. The distribution system of a water works plant costs many times as much for equal available power as that of the electric plant. In the one case the power has to be transmitted through costly cast-iron mains, laid underground, while in the other a few slender copper wires suffice. These items alone may readily result in making the first cost, and therefore the fixed charges of the water works plant, from two to four times as great as that of an electric plant of the same horse-power.

The efficiency of small water motors is less than that of electric motors of like power, so that, assuming equal station efficiencies and transmission losses, and assuming, furthermore, that the city water is not filtered, the actual operating expenses, exclusive of fixed charges, would be less for electric than for hydraulic power. If the expense of filtration has to be added to the other costs of the water, the difference in favor of electric power is at once enormously increased.

The foregoing items would be enough in themselves to explain why water works plants have not been able to successfully compete with electric plants in the sale of power for small units, as was once thought possible; but there are yet more conditions which operate in favor of electricity. The supply of water is, oftener than not, limited, and water used for power purposes would be taken during the day, which is already the time of maximum consumption.

With an electric light and power plant, however, the heaviest load comes after business hours, so that the sale of power for elevators, office fans, and motors for industrial purposes can be, and usually is, made at much lower rates than would be possible if the capacity of the station had to be increased to meet this extra demand.

In view of the foregoing facts it would seem that the instances in which the water purveyor can hope to sell power at a profit will be very exceptional; and that his laudable efforts to increase his business had better be directed to securing, at the least possible outlay for extensions, more consumers of water for domestic uses and for fire protection.

Engineers and Architects' Plans.

Plans for structures and machinery must obviously be prepared and used suitably for the purposes intended. In general the plans of engineers and architects are drawn not only to show structures and machines as such, but also to be used as a basis for estimates of costs, if contract plans are included under this head. These plans, however, are seldom elaborated sufficiently in detail to be used as the shop or construction plans. This is a distinction probably much more generally recognized and acted upon in the architect's practice than in that of the engineer, but it is at least equally true of the latter. It is a feature of the engineer's business that ought to receive far more careful attention, both on the part of the engineer and contractor, than is usually the case.

An engineer entrusted with the duty of first designing and then constructing any structure or plant must develop his plans for a far wider and more complicated purpose than the mere construction of its various parts. His client must be reasonably assured by the general layout and composition of the whole subject that his main object is to be attained. While the details may pertain to matters beyond his technical comprehension, the case is unusual where his scrutiny does not reach to the main purposes of the contemplated work. On the other hand, the shop manager or the constructor is less concerned with the main motive of the work than with the details of the thing to be constructed. These are the main points to be considered in draughting plans, and if the latter are not so produced as to meet the requirements based on them, or to express them, obscurity, confusion and controversies of the most serious character are likely to follow.

It does not follow that because general or contract plans are not elaborated in detail they should not be based upon the most thorough study of the whole project which they represent. Herein lies the root of nearly all the troubles and controversies over "extras" in the final settlements of many contracts. No general plans can be drawn suitably for a contract or for a reasonably accurate estimate of cost unless the main details have been established. It is a strong temptation, especially in the architectural profession, to indicate in a general way only, in the contract plans, what is wanted, leaving most or all the main details, and sometimes principal portions of the work, for subsequent development. The engineer who has not had shop experience or much contact with actual construction in the field is far too little impressed with the seriousness of this branch of his business. It may be laid down as a fundamental principle that no general or contract plans for the execution of work without misunderstandings and controversies can be draughted unless the whole system of main details has been finally worked out and they are at least expressed by clear suggestion in those contract plans.

This dictum does not in any way trench upon all needed latitude for either the exigencies of construction under difficult conditions or the proper evolution of those parts of a work which involve the finer details. It is not necessary that the engineer should make the final plans of details if he has drawn proper specifications, although he should completely control them by exercising the right of approval. Indeed, there are many cases where it would be injudicious for him to do so, as it would result in much lost time and wasted efforts. The whole field of iron and steel construction illustrates this point most forcibly. In general, no engineer knows in advance where the structural iron or steel work planned by him is to be built. At the same time, nothing is better known than that each shop has its own system of procedure, in the main similar to others, but different enough from them to give individuality to its own operations. This individuality is the source of legitimate preference in many details and there is no valid reason for denying its exercise. Again, every bridge draughting office has not only its own system of preferable details, but also its own system of representing them, including marking, dimensioning and other features. It is impossible for any engineer to incorporate these particular characteristics in his structural plans. If he should attempt to accomplish that end, he would inevitably fail, and, in any event, each shop would necessarily have to prepare its own shop plans in order to make them intelligible to the foremen in charge of the actual fabrication of the members of the structure.

What is desired, and indeed is imperatively necessary, is such a carefully studied, well-thought-out and completely developed treatment of the project that its general plans may be based upon the main details as they will be built, so that, with the specifications, there will not be the slightest doubt as to what is to be done or as to the precise character of the work.

It cannot be denied that in many cases with both engineers and architects these requirements are not fulfilled. Plans are not clear as to the information they ought to convey and specifications are too frequently worse. The engineer's drawings should not be shop drawings, and they should be clear and complete enough to enable any reputable bridge office to make shop plans quickly with the aid of the specifications. In other words, he should set forth precisely what he wants, at the same time giving the shop or the constructor legitimate freedom under approved final detailed plans.

It is undoubtedly a fact that many plans are prepared by both engineers and architects without a clear idea as to just what function they will perform even though they are used as contract drawings. This is due largely to lack of familiarity with the requirements of working plans, i. e., with the data actually required in the shop and in the field. It is possibly too much to ask the professional schools to set forth such matters to their students, and yet a little instruction on such points would be of great service ultimately to the practitioner.

Range and Thoroughness in Technical Studies.

A few months ago, Dr. W. F. Hillebrand, the eminent analyst, read a paper before the American Chemical Society on the present condition of analytical chemistry. The position the author occupies among specialists and the great importance of analytical work in many industries and engineering problems, lend particular interest to his opinions. He frankly acknowledges that the frequent charges of bad analytical work are fully substantiated. This is a subject which chemists, not engineers, must settle. The explanation of the poor condition, however, which Dr. Hillebrand offers is rather startling, being nothing less than poor instruction in technical schools. "We may analyze the causes for the variations shown in the analyses of the same, or supposedly the same samples, and, neglecting the inevitable personal factor, find that in certain cases the sampling was inaccurate, in others that the water was bad, the reagents faulty, their effect on the glassware used greater than had been suspected, or that of several methods for reaching the same end one or more are of doubtful value unless used with that knowledge which can only come of long practice, sharpened by discriminating judgment. But in the ultimate analysis these distinct causes nearly all lead back to one stem root—some defect in the early education of the chemist—for which the institutions that are yearly sending forth young chemists, supposedly fitted to do good work in their chosen lines, are responsible."

In view of similar criticisms of engineering courses of instruction, it is interesting to observe that the reason assigned for this condition by Dr. Hillebrand is precisely the same as the explanation frequently given for the defective education of engineering students, namely, lack of thoroughness due to an attempt to teach too many subjects. It does not lie in teaching incorrect methods. "It seems to me," says this eminent chemist, "that if instruction in fundamental essentials is not thoroughly drilled into the budding chemist, so that it becomes for him as much a matter of course afterward to look to the quality of his tools as it is to weigh out his sample before analyzing it, he has received a scant equivalent for his years of study and has good grounds of complaint against his alma mater if he comes to grief by reason of her neglect. . . . It is far better that the student should learn to do a comparatively few things thoroughly, mastering the whys and wherefores of every step, than a great many superficially and without acquisition of the underlying principles. It is only the one thus thoroughly grounded who is in a position to use or devise short cuts without great danger."

It is interesting to observe how some of the detailed criticisms made in this address check with comments of eminent engineers on engineering instruction. It is asserted that chemical analysis is taught by schemes of analysis rather than by the facts on which schemes are based. This is believed to be the result of inadequate corps of laboratory instructors, just as the engineering student suffers by doing his work in large classes by recitations, which fail to be of much educational value or to indicate to the instructor the troubles of the majority of the students, who are generally too modest to make them known by questions in the classroom. It is not surprising, of course, to those who know the limited financial resources of most technical schools, that this condition obtains; it is no criticism of the earnest work of a faculty that it exists, but rather of the trustees who encourage the teaching of a smattering of advanced subjects requiring elaborate apparatus and generally useless in after life to most students.

Another feature of chemical instruction that finds its counterpart in engineering courses is superficiality due to the approximate nature of much work done in regular chemical practice. Dr. Hillebrand states that he has often heard the statement made that reagents were good enough for technical work, and expresses his opinion that this opinion, often radically incorrect, is responsible for lack of appreciation among young graduates of the fact that good work requires good tools.

In his opinion, the best educated chemists are those who know the fundamental subjects so thoroughly that when it is necessary for any reason to employ proximate methods they can do so with a full appreciation of the extent and character of each source of error involved in such approximations. Chemists in charge of large industrial laboratories sometimes prefer young men not too well informed as to a variety of methods, but would have them come unfettered by preconceived notions and ready to adopt, without objection, the methods in vogue in the particular laboratory.

A strong confirmation of this opinion was recently given to this journal by one of the leading civil engineers of the country, who has employed hundreds of technical school graduates. In his opinion, there has been a steady tendency to sacrifice thoroughness to range of subjects. The young men who come to him do not have, as a rule, a really thorough grasp of the fundamental facts of mechanics, but are equipped with a superficial knowledge of special subjects, which, so far as they relate to his work, must be beaten out of them and retaught before they be intrusted with even a limited degree of responsibility. In his opinion the only subject of direct, immediate value to many of them which they have acquired in their school work is a knowledge of mechanical drafting.

Such criticisms as these, coming from men of high professional standing, should not be ignored. The inbreeding that has been going on in the teaching staffs of technical schools is largely responsible for it. It is the result of an attempt to teach numerous specialties in the brief time that should be given to the acquisition of definite knowledge on the subjects from which specialties are developed. The task is impossible with the average student.

Notes and Comments.

Asphalt Pavements laid in Buffalo prior to 1883 and still in use amount to 54,682 sq. yd. All were made of Trinidad asphalt, and cost $140,956. One which was laid in 1878 under a five-year guaranty was resurfaced in 1883. The total cost of repairs on these streets from the time they were laid down to June 30, 1904, has ranged from 31.61 to 72.68 cents per square yard. In this connection attention should be called to the excellent records kept of the cost of construction and repairs of Buffalo pavements. The data are very complete and tabulated by years, so that engineers interested in the subject can ascertain how much work has been needed to keep any pavement in condition after it was once laid, and the extent and cost of the repairs made in each year.

The Harvard-M. I. T. Alliance was pushed forward another step on June 9, when the Institute trustees voted to announce to the corporation of Harvard University the willingness of the Institute to co-operate, in accordance with the tentative plan under discussion, provided that there shall be obtained, first, a favorable decision from the court concerning the Boylston St. land, and provided also that it (the Institute) shall apply to the Supreme Judicial Court for instructions, and that the court shall have made a decree that this agreement may be carried out without violation of the duties of the Institute as a trustee. This action is contrary to the wish of the alumni of the Institute, who recently voted in the ratio of 3 to 1 against any alliance.

Greater Economy in the Use of Fuel at the mine workings in the Pennsylvania coal districts is becoming evident. Where formerly the best grades of coal were used lavishly, as well as inefficient boilers and apparatus, the tendency now is to use water-tube boilers of the highest grade, economizers and feed-water purifiers, and to use stokers for burning the lowest grades of slack from the culm piles. A striking example of economical operation is to be seen in the Hampton central power plant of the coal mining department of the Delaware, Lackawanna & Western R. R., which delivers steam to an adjacent steam turbine power plant and through long pipe lines to various mine workings. This plant has fifteen Babcock & Wilcox water-tube boilers of 313 h.p. capacity each, operating at 150 lb. steam pressure. Each is equipped with McClave inclined stokers for the successful burning of culm. Both forced and induced draft are used and the feed water is heated in Green economizers. The culm is dumped directly into elevated storage pockets or bunkers over the stokers by cars from a nearby breaker, and the ashes are flushed down a bore hole into the mine below for filling.

The Grooved Rail has long been a pet hobby of the engineer who has to lay and maintain pavements. It is certainly far better than the T-rail when the latter is improperly used. It is a question, however, how long it will remain in use in some places. For example, on steep streets in winter the groove becomes filled with ice and the wheels run on their flanges instead of the treads, rendering it difficult to control the car and endangering public safety. This is not so serious, however, as the effect of these narrow grooves on the safety of high-speed interurban electric traffic. Steam railroad men have long criticised the safety of these high-speed cars because of the thin flanges of the wheels, made necessary by the narrow grooves in the rails. Two accidents have recently proved how real is the risk. Both occurred in Cleveland, where grooved rails are required by ordinance. In each case the accident occurred on a bridge and the escape of the passengers from a horrible death was little short of miraculous. When it is reflected that a small stone or piece of iron in the groove may cause such a derailment, it is safe to say that the rail problem is not solved and that engineers must take it up again. With the small flanges grooved rails permit, a serious accident must result sooner or later, and this will open up the subject for the serious discussion it deserves.

Steel-Cage Buildings cannot be constructed in London, according to a writer in the "Times' Engineering Supplement," without sacrificing to the defective building laws one of the most important advantages of such structures, the utmost utilization of room. The laws require the following thicknesses of external and party walls for a building 120 ft. high: First story, 34½ in.; second and third stories, 30½ in.; fourth and fifth stories, 26 in.; sixth, seventh and eighth stories, 21½ in.; ninth and tenth stories, 17½ in.; eleventh and twelfth stories, 13 in. With the usual steel-cage construction adopted in America, no such thicknesses would be used, and much valuable floor space would be saved, as well as expenditure for needless masonry. Moreover, the use of the steel framing has the great advantage of saving room in the basement and sub-basement, which is generally the most crowded part of a high office building or hotel. With self-supporting walls, the masonry below the sidewalk level often takes up room that is greatly needed for the mechanical equipment of the structure and for storage space. Inasmuch as the use of thick walls with steel-cage construction has nothing whatever to recommend it and is needlessly expensive, it seems probable that the London building act will be modified before long to permit a rational use of steel and masonry construction.

The Park Avenue Tunnel Accidents during the construction of the Subway Railroad in New York are recalled by a decision of the New York Supreme Court, Appellate Division, on May 12. The section of that road under Park Ave., between 34th and 42d Sts., was not built legally. The original location of the two tunnels was never approved by the property owners, but was confirmed against their opposition by the Supreme Court. Subsequently, the location was materially changed by the Board of Rapid Transit Commissioners and the contractors, the tunnels being placed within a few feet of the property lines instead of in the middle of the streets. The progress of the work was attended by serious injury to adjoining property through settlement. The Commissioners have since been trying to secure the court's approval of this departure from the authorized plans. In the decision just rendered the court states that before giving this approval, "those interested in constructing and operating the road" must compensate the property owners for damages caused by "the illegal and unauthorized construction of the road under the street adjoining their property." The court further orders the road to be rebuilt according to the original plans, which were alone authorized, and the street to be restored to its condition before the unauthorized construction was executed, unless the city and the contractors or lessees of the Subway make a fair and reasonable arrangement with the property owners. This reconstruction would be a very difficult and costly undertaking.

THE HIGHWAY BRIDGE OVER THE WABASH RIVER AT TERRE HAUTE.

A STRUCTURE HAVING AN UNUSUAL COMBINATION OF TRUSSES AND PLATE GIRDERS.

The new highway bridge across the Wabash River at Terre Haute, Ind., is 812½ ft. long between abutments, about 74 ft. wide over all and carries a roadway and two sidewalks 50 ft. and 8 ft. wide in the clear respectively. It replaces a wooden Burr truss toll bridge built in 1864 with five three-truss, 160-ft. spans and a short bascule draw span, all with a level floor about 5 ft. above extreme high water. The old trusses were in extremely good preservation except that the timber, consisting chiefly of yellow poplar with a few oak main braces, was brash. The stratified limestone piers with pile and grillage footings were so badly weather checked that they were condemned and used for rip-rap around the new piers.

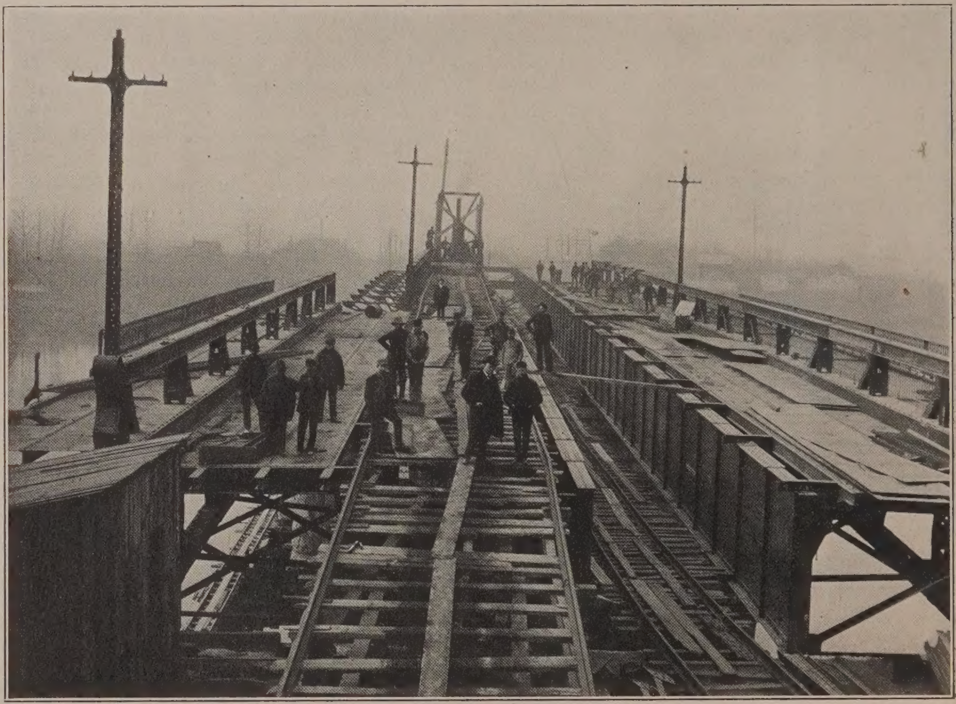
The new bridge has six duplicate 120-ft. fixed steel deck spans and one 75-ft. lift span with a floor 14 ft. above that of the old bridge in the center sloping down to both abutments with a 1.225 per cent. grade. All of the sub-structure has pile foundations with concrete footings. The green, hardwood piles were driven by a drop hammer and a water jet to a penetration of about 20 ft.. The piers are built of quarry-faced Bedford limestone ashlar, backed with concrete, down to low water line, and to a depth of 9 ft. below that point are of concrete. The abutment masonry extends only 2 ft. below low water and is not bonded to the wing wall masonry which is seated directly on the earth without pile footings.

The six fixed 120-ft. spans each have two 51,400-lb. riveted trusses about 121 ft. long, 45 ft. deep at the ends and 30 ft. deep at the center over all, and 53 ft. apart on centers, which are nearly in the curb lines. The bottom chords of these trusses are curved to give them an arch-like effect and the horizontal top chords are 4½ ft. above the curb, forming barriers between the roadway and sidewalks. The trusses are made with stiff members throughout, with cross sections and details of connections as indicated in the elevation of the two end panels, which are typical of the whole truss. The diagonals are made with solid web plates ¼ in. thick, which are not considered as effective in the working cross section. All members were shipped separately and field-riveted together through gusset plates with curved edges, shop-riveted to the webs of the top and bottom chords.

The feet of the vertical end posts engage pins in shoes which, at the expansion ends, are seated on 792-lb. nests of 8-in. segmental rollers with steel T-rail bed plates set with ¼-in. sheet lead fillers on stone pedestals 14 in. thick. The rollers are connected by top and bottom end strips and the latter are unusual in that they are made with angles, utilizing the horizontal flanges for connections with the anchor bolts engaging slotted holes. At the fixed ends the pedestals are seated directly on 1,280-lb. rail bed plates and have projecting horizontal plates riveted to their bases to receive the anchor bolts. In both cases the bed plates reach across the tops of the piers and receive two shoes each. The vertical posts are made with pairs of channels latticed, having their webs parallel to the bridge axis. The inner channels are web-connected to the I-beam floorbeams which are seated on solid web knee braces which also afford connections for the sway-brace diagonals.

At the ends of the bridge, the upper corners of the trusses were finished, over the abutments, with extensions built up of flange angles and curved cover plates enclosing the tops of the vertical posts with a scroll work effect. The spaces of about 18 in. between the vertical end posts of adjacent spans are filled by panels of light steel scroll work bolted to both vertical posts and flexible enough to conform readily to the slight longitudinal displacements of the trusses. In each span the space between the top chord and the curb is filled by panels of light twisted steel vertical bars supported from the top chords at intervals of 4 ft. The sidewalk brackets carry, at the outer ends, a light facia girder with a Z-shaped top flange built up with a 3 x 3-in. inside angle and a 6 x 4-in., 12½-lb. bulb angle affording support for the floor plates and for the ornamental fence. The latter has riveted vertical posts with solid web plates and double curved flange angles and is secured to the cantilevers and fascia girders by screw rows with double nuts.

Between the trusses the roadway is carried on three lines of deck plate girders 121½ ft. long and 10 ft. deep over all which weigh 60,500 lb. each and are believed by the designers to be the longest highway plate girder spans yet built. They are of the simplest possible construction with web plates ⅜ in. thick throughout, made in 7½-ft. sections spliced with four vertical rows of rivets in a pair of 12½ x 5/16-in. cover plates at each joint. The web is stiffened by a pair of 3 x 4 x ⅜-in. crimped vertical angles at each splice, and by four extra pairs at each end. Each flange is made with a pair of full length 6 x 6 x ⅞-in. angles and four unspliced 16 x 7/16-in. cover plates, 97 ft., 83 ft., 68 ft., and 47 ft. long. The fixed ends of the girders are knee-braced to the tops of vertical posts 38 in. high with extended bases seated on rail beds and anchor bolted through the latter to the pier masonry. At the expansion ends double-web shoes are riveted to the lower flanges and engage 5-in. pins through the tops of vertical rocker posts about 2 ft. long on centers. The feet of these posts are pin connected to fixed shoes like those shown for the outside trusses, which are seated on rail beds and anchor-bolted to the masonry. The girders are braced transversely as indicated in the half cross section of the fixed span, and have gusset plates field-riveted to their vertical web stiffeners to receive the sway brace angles and serve as knee-braces and shelf supports for the floorbeams, 7½ ft. apart. In the side panels the latter are web connected to the stringers and in the center panels the stringers are seated on the top flanges of the floorbeams, all of them being arranged to provide a suitable crown for the roadway surface.

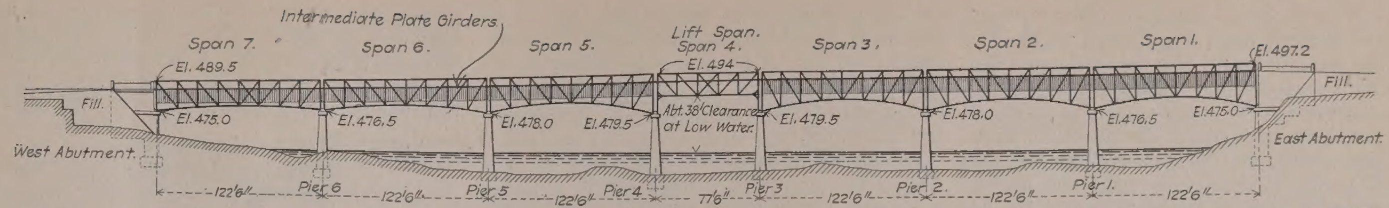


Building Floor Platform and Erecting Main Girders of Adjacent Spans.

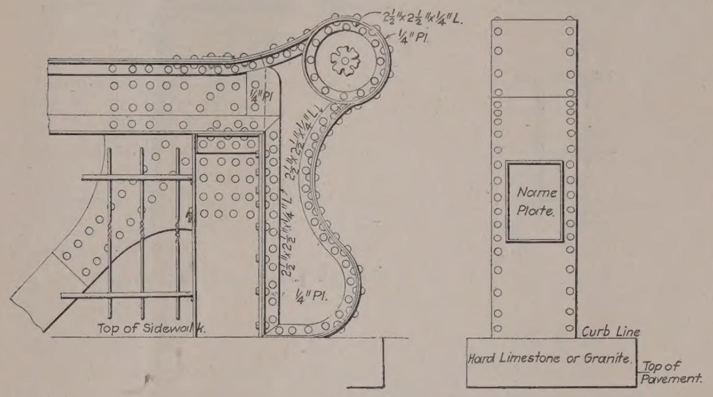
The 75-ft. span is designed to provide for a movable section of roadway over the channel, but the operating machinery will not be installed until required by the United States government. It has in the planes of the fixed-span trusses two 40,000-lb. main trusses made with details conforming with theirs. The vertical end posts are kneebraced and prolonged nearly 8 ft. below the bottom chords and at their feet engage shoes like those of the fixed trusses. At each of the six panel points the trusses are connected by 16,000-lb. transverse plate-girder floorbeams web-connected to the vertical posts. These carry ten lines of 12-in. I-beam roadway stringers and two lines of 15-in. I-beam track stringers web-connected to them flush with the top flanges.

The bridge is proportioned for a concentrated live load of 20 tons on two axles 12 ft. c. c., on any part of the roadway, or for a uniformly distributed load of 100 lb. per square foot over all, axles 12 ft. c. c., on any part of the roadway, or for two electric car tracks in the center, or for one electric car track each side of the center line with 27 ft. cars with two axles 7 ft. apart loaded 20,000 lb. on each, or for one 40-ft. car with four axles spaced 10 and 15 ft. from the center and loaded 15,000 lb. each followed by a trailer car with the same dimensions, each axle loaded 10,000 lb. The sidewalks are proportioned for a live load of 100 lb. per sq. ft.

Buckle plates 5/16 in. thick, are riveted convex side down to the top flanges of the roadway and sidewalk stringers and are drained by small holes in the center of each panel. They are covered with at least 3 in. of concrete, with a sand cushion in the driveway for the brick pavement. The concrete is made 1:3:5 with Great Northern & Marquette Portland cement, and for the sidewalks is finished

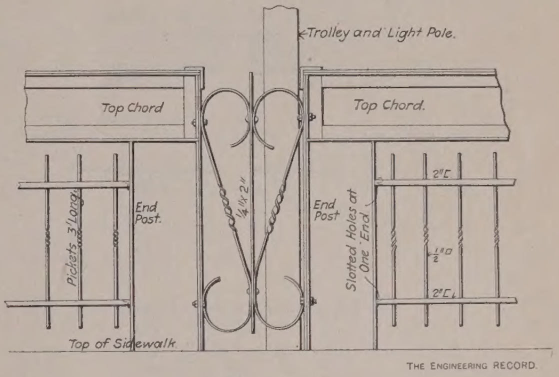


THE ENGINEERING RECORD.



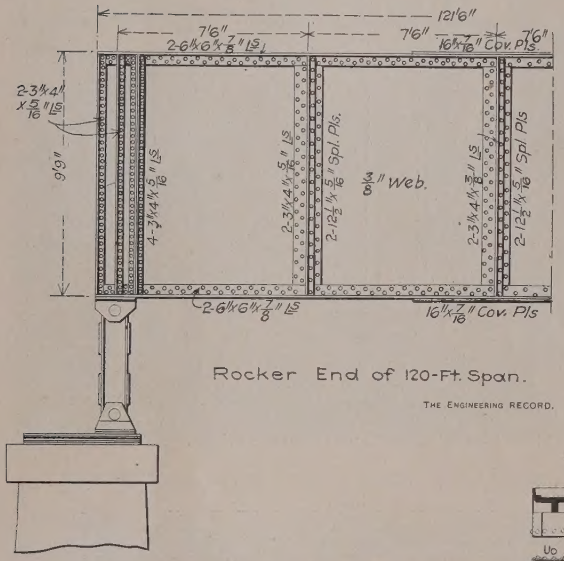
Ends of Trusses at East Abutment.

THE ENGINEERING RECORD.



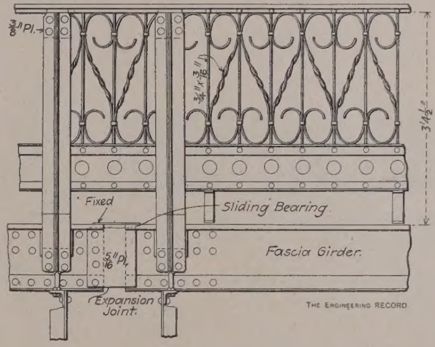
THE ENGINEERING RECORD.

Fence between Sidewalk and Roadway.



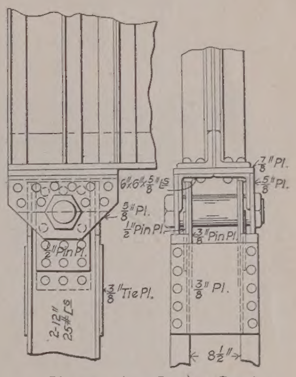
Rocker End of 120-Ft. Span.

THE ENGINEERING RECORD.



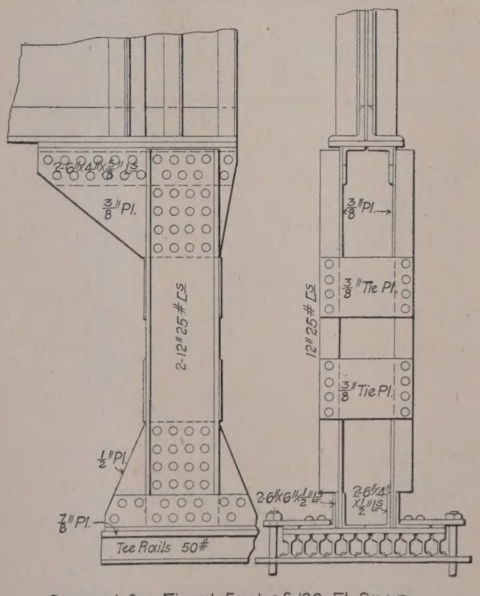
THE ENGINEERING RECORD.

Railing over Pier.



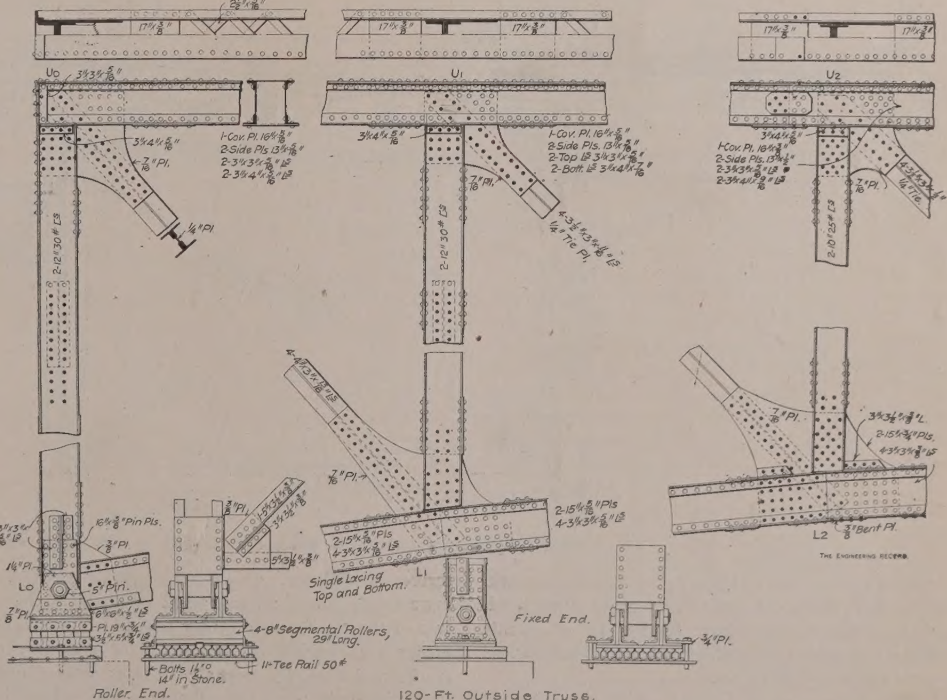
Pin Bearing Rocker Bent of 120-Ft. Span.

THE ENGINEERING RECORD.



Support for Fixed End of 120-Ft. Span.

THE ENGINEERING RECORD.



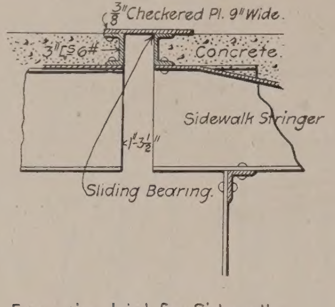
THE ENGINEERING RECORD.

Roller End. 120-Ft. Outside Truss. Fixed End.

GENERAL ELEVATION OF WABASH RIVER BRIDGE AND PRINCIPAL DETAILS OF FIXED SPANS.

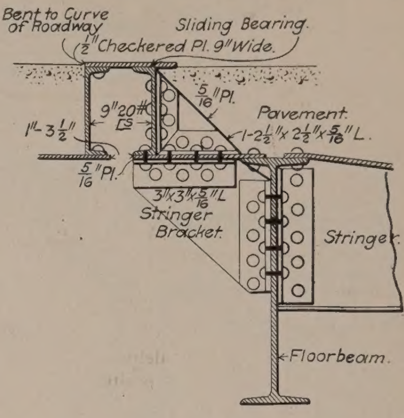
with ¾-in. 1-1 mortar. Expansion joints at every pier are designed for a displacement of 2½ in. and are made, for both roadway and sidewalk, with horizontal cast-iron checkered plates 9 in. wide supported on the top flanges of two channels, one under each edge. The plates are flush with the roadway and sidewalk surfaces and are riveted to the channel at the fixed end of the span and slide freely on the channel at the expansion end.

The principal quantities in the new bridge include 6,230 cu. yd. masonry and 718 piles in the sub-structure, and 4,159,328 lb. of metal work. The latter item embraces drain pipes, sheet lead, rails, and rail fastening; 689,855 lb. of buckle plates, 74,300 lb. of railings and 3,306,946 lbs. of structural steel, invoiced.



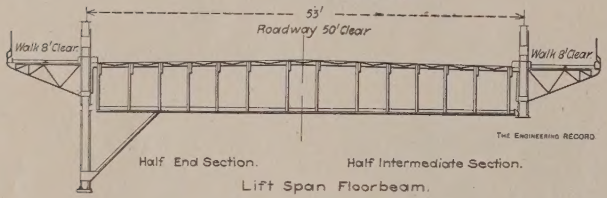
Expansion Joint for Sidewalk.

THE ENGINEERING RECORD.

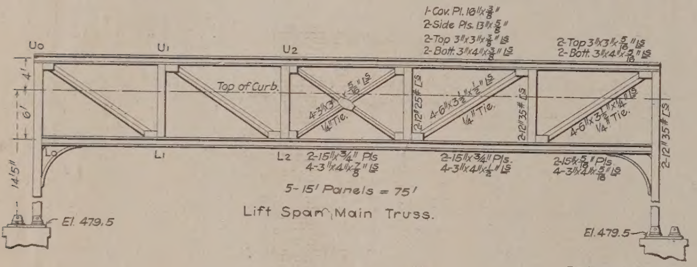


Expansion Joint for Roadway.

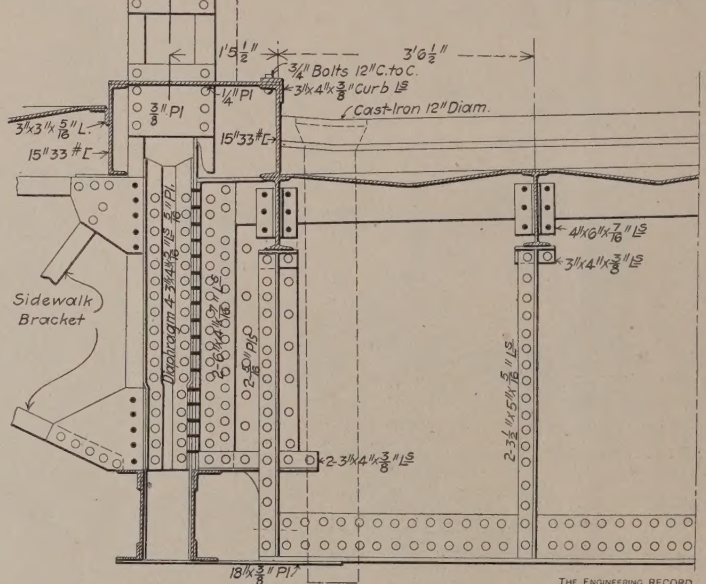
THE ENGINEERING RECORD.



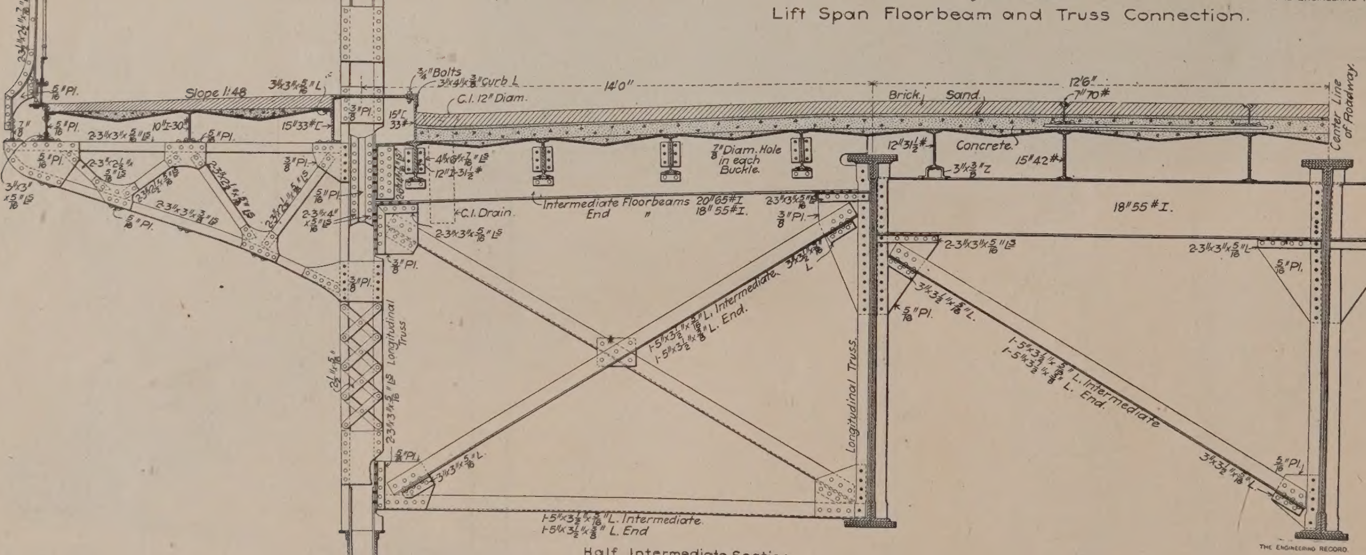
Lift Span Floorbeam.



Lift Span Main Truss.



Lift Span Floorbeam and Truss Connection.



Half Intermediate Section.

Half Cross-Section of Fixed Span and Details of Lift Span and Floor Joints.

The contract price for the entire structure, including a temporary bridge, the removal of the old superstructure and substructure, etc., was $271,200.00, of which $192,500.00 may be considered as the cost of the new superstructure, the temporary bridge and the removal of the old bridge, and $78,700.00 the cost of the substructure and approaches.

The method of erection was a novel one, involving the use of only a small amount of false work and assembling the structure progressively so as to handle the heavy girders and trusses with simple plant and a small number of men.

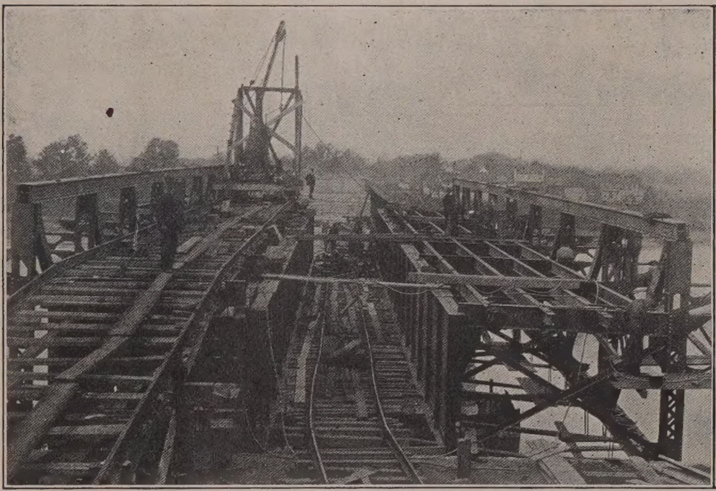
The principal operations may be briefly described as follows: False work capable of carrying a single line of railway track was built between two of the 120-ft. plate girder positions. A single girder was loaded on two standard freight car trucks and then, by means of tackles, moved out until the ends were over the masonry, where it was placed on blocking and moved sidewise until in its proper position. When the girders for a span were in position, the floor beams, stringers and sway bracing were put in place and bolted up. The riveted trusses were assembled by placing the floor beams running from the trusses to the adjacent girders on top of the deck already formed and anchoring them down with the outer ends projecting beyond the girders about 2 ft. Then the truss verticals were bolted in place and the remaining members assembled and bolted. The outside rivets were driven and then the truss and floor beams moved sidewise and lowered into their proper positions. One-half of the bridge was erected in this manner and then the false work for three spans was moved forward, the railway track being shifted to the lower flanges of the plate girders in place.

The beams, stringers, truss members and other pieces were handled by two booms of a light wooden traveler operated by a Mundy hoisting engine and moving on a wide-gauge track laid on the floorbeams between the plate girders. The plate girders were handled by four 25-ton Norton ratchet jacks. The field rivets were driven by four Boyer pneumatic hammers operated by compressed air from a Norwalk and a Monarch compressor permanently located on shore. After erection the steel work was painted with paint manufactured by the Illinois Steel Co. An average force of about 75 men was employed on the erection of the superstructure. It required a minimum of 1½ hours to deliver a 120-ft. girder, 5 hours to move it out to position and about 35 hours to assemble a 120-ft. truss and move it out to position. The quickest time of erection of beams, stringers and bracing for one span complete except the buckle plates, was 20 hours. The riveting was done by 3½-man gangs, who drove an average of 400 ¾-in buckle plate rivets in 10 hours at an average total cost of $8.75.

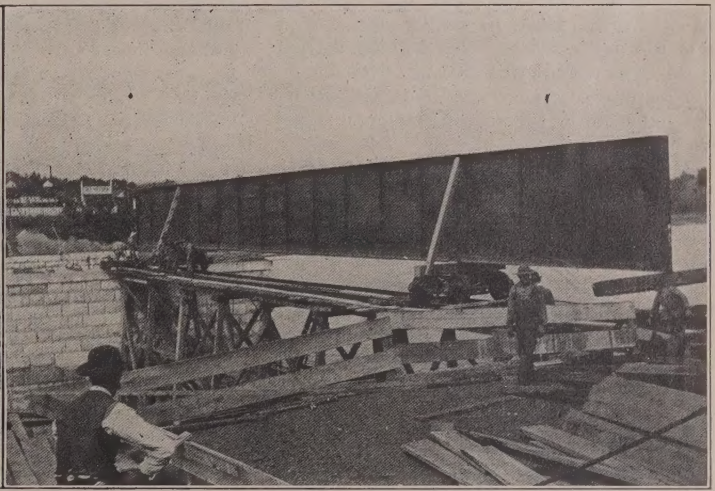
There were about 125,000 open holes to be filled with ¾-in. and ⅞-in. rivets. Of this number comparatively few were filled with bolts. Curb angles and stringer shelf angle connections were bolted, and a few end floor beams, where it was impossible to drive rivets, were connected with turned bolts having a driving fit with nut and washer on each end.

The only delay in traffic experienced was a few hours Sunday afternoon when the ice took out the temporary bridge, and a few hours on the following Monday required to complete a plank roadway on top of the buckle plates floor. Some of the trusses had not been riveted up when this occurred, but the joints were securely held in place with bolts and drift pins. Sixteen feet of the roadway was used for traffic while one-half was paved; then the traffic was turned onto the pavement and the remainder paved.

The contractor for the entire work was The Lafayette Engineering Co., Mr. Wallace Marshall, president; Mr. Frank Hanna, general manager at Terre Haute, and Mr. O. G. Wright, superintendent of erection. The steel work was fabricated at the Detroit branch of the American Bridge Co. The mill and shop inspection was done by the Pittsburg Testing Laboratory. Mr. Malverd A. Howe and Mr. J. E. Starbuck were designing engineers and superintendents of construction for the Commissioners of Vigo County.



Ready to Move Second Truss of Wabash River Bridge Transversely.



Ready to Lower Plate Girder to Position.

The Formation of Anchor Ice.

In cold climates anchor ice is a source of some of the most annoying experiences of managers of hydraulic power plants. A large number of articles on the subject have been printed in this journal, but none so complete as a paper presented at the Scranton meeting of the American Society of Mechanical Engineers, by Dr. Howard T. Barnes, of McGill University. His attention was first called to the subject by Mr. John Kennedy, chief engineer of the Montreal Harbor Commission, which had been unsuccessful in studying the subject because of the inaccurate data obtained by their observers. At McGill University a thermometer was made depending for its reading on the change in the electrical resistance of platinum wire. The degrees on the indicator had a length of 8 in., which made it possible to read the temperature to the ten-thousandth part of a degree.

In order to understand the way in which anchor ice forms it is necessary to bear in mind the difference between the three recognized methods of transmission of heat, convection, conduction and radiation. The first method, convection, is the transmission of heat by the movement of matter itself. It depends entirely on the fact that matter when heated expands and becomes less dense. Therefore, a heated portion of matter surrounded by cooler matter will be displaced by the cooler matter as a light object is displaced by water. We have one exception to this in water at 4° C. At 4° we have the maximum density of the liquid occupying the least volume. Below that point to zero, water expands. Above that point, water expands; hence we see that in the case of water the process of convection will cause a current of warmer water to rise until we get to 4°, and then the reverse process will take place. Below 4°, as the water becomes cool, the warmer layers sink to the bottom.

The next process of heat transmission is conduction, the transmission of heat from point to point in the body. Conduction only affects the ice problem in so far as it causes a thickening of the sheets of ice over a river or lake.

The next process is that of radiation, or the transmission of heat by ether waves.

The problem of heat transmission by radiation is the most difficult. We know the least about it. The difficulty in applying the laws of radiation to practical engineering problems is that we do not know enough about surface conditions or radiation from cold bodies. Bodies differ a great deal in their power of absorbing rays. Some bodies transmit heat waves; some do not. Tyndall has shown that for heat rays water and ice are very opaque, and he has pointed out that of the longer rays which are emitted from an object heated 100° above its surroundings, the surroundings being the ordinary temperature of the room, these would be entirely stopped by a mass of water.

We know that ice is very plastic; it can be molded into various shapes. We have examples of ice which has been pressed between heavy molds to form perfect spheres; and ice that is pressed in a cylinder may be forced out of a narrow opening. Ice, however, does not exhibit the characteristic properties of viscosity. An illustration of this is the glacier action. A glacier in moving from a narrow passage to a wide passage cracks instead of adapting itself to the wider passage. A glacier moving down over a very gentle slope will crack on lines at right angles, showing that ice is exceedingly brittle. The phenomenon which enables it to give under pressure is probably due to another physical property of ice, namely regelation. One hundred and fifty atmospheres pressure will lower the freezing point of water and ice 1° C. By means of pressure we can freeze blocks of ice together. A slight film of water is formed on the touching surface and immediately the pressure is relieved the water in contact with the ice surface finds itself below the normal freezing temperature and at once solidifies, cementing the two blocks together.

There is another property which ice possesses and which has quite recently been measured. That is, it possesses the power of growing by itself; ice in contact with water exactly at the freezing point apparently goes on growing. If we allow the natural rate of growth to go on it would form an inch in about two and one-half years, so it does not form a very important factor in practical engineering problems. It forms an important factor, however, in that it helps to cement ice crystals together. It was Faraday who first showed that if we had some cracked ice floating in a vessel, by taking one of the pieces of ice and bringing it in contact with another piece of ice it would stick to it; no pressure was required, merely contact. At the point of contact we have two ice surfaces with zero water between, the ice would be growing all the time and hence the two pieces in contact would at once adhere.

The curve showing the variation of the specific heat of water drops very rapidly from 0° C. and passes through a minimum of 40°. That is apparently due to the fact that besides the heat absorbed in the natural expansion of the water we have the heat absorbed in transforming ice molecules into water molecules. That is, as the temperature rises, the amount of heat that would be absorbed by the ice becomes less and less. At

40° C. we have an exact balancing. From 40° we have the water existing as a pure liquid.

There is an increase of about 9 per cent. in volume, and this is exceedingly important inasmuch as the ice as soon as it is formed comes to the surface or remains on the surface. Take for example a sheet of quiet water which is cooled by the advent of winter weather. The surface becomes cool; the cooler layers fall to the bottom until 4° is reached. Then the warmer layers stay at the bottom and the cooler layers remain on top. As soon as the surface gets to the freezing point ice forms. This ice spreads over the surface, usually from the banks toward the center, and gradually increases in thickness by conduction. To the convection of air currents we probably owe the fact that the ice spreads from the edges to the center, because the water heats the air and it therefore rises from the center and colder air sweeps in from the banks to the middle. We therefore have the water along the edges always in contact with colder air than at the center.

Consider what goes on in the case of a river which is flowing too rapidly to form a surface of ice. Naturally we will have instead of the flat surface ice, ice of finer quality formed. Each little piece of ice produced by the cooling of air on the surface is carried down by the currents and submerged, rising to the top again as the currents carry it above. Not forming the protecting layer of ice the flowing river loses a very much greater amount of heat and the fine ice is produced by agitation in very great quantities.

These fine crystals of ice, called frazil crystals, are swept down with the current for long distances from open water under the surface ice. It was one of the discoveries of the Flood Commission of Montreal that frazil ice was found many miles below the bordage ice at the foot of the Lachine Rapids, where the greater portion of this ice is formed. An inspection of the many diagrams of the Flood Commission for various sections of the St. Lawrence River below the city of Montreal, shows an immense accumulation of frazil or what the engineers have called also sponge ice. In determining the depth of the ice a lead could be lowered through by slight pressure from above, and it was found that this ice accumulated under the surface ice to depths ranging from 30 to 35 ft. In general, wherever an open river flows unprotected, quantities of this frazil ice are formed by radiation and by convection of air currents and wind agitation. These crystals of ice vary in size, depending upon the agitation of the water. The more rapid the agitation the finer they are, and the farther they travel the larger they grow.

There is another form of open water ice which we must consider and which is primarily the subject of this paper—anchor ice. Anchor ice and frazil ice are often mistaken for the same thing. Frazil ice is formed in the water itself by surface agitation and other causes. Anchor ice grows on the bed of the river, on the rocks, on anything in the bed of the river to which ice may be attached. There is still a difference of opinion as to how it first forms; but Dr. Barnes thinks that when we consider the amount of heat lost from the surface of a river by radiation and the fact that much of this heat can penetrate through the water, we must admit that radiation plays an important part. When we consider further that this anchor ice is formed only at night when the radiation from the earth is a maximum, that as a rule it never grows under a bridge or under any object which would reflect the heat rays back again into the water, and when we consider that anchor ice apparently grows more rapidly on dark rocks than on light rocks, then we must admit there is strong suspicion that radiation plays an important part in its formation. That anchor ice is built up as well by the freezing to the bottom of frazil crystals goes without saying. It could not do otherwise. These surface currents carry down the fine pieces of ice, which, passing across the layer of anchor ice which may have formed there by radiation, become attached, and we have then great thicknesses built up in a single night. Anchor ice is formed partly by radiation and partly by the sticking to the bottom of these frazil crystals. Anchor ice, during a severe spell of weather, when it is cloudy by day and clear by night, attains a thickness of several feet, such that a pole or a stick placed on the ice will sink into it to considerable depths. When the sun rises it has been noted for a long time that these masses rise to the surface. The boatmen are very chary about going across an open channel when the sun is bright, for these masses come up in great quantities. As soon as the sun gets at a sufficient angle so that its rays penetrate the water, they pass through the water and ice, warm the bed of the river and warm the water in contact with the ice. The ice rises with a characteristic hissing noise several feet above the water and then falls back, turning white as the water drains out of it. It floats low in the water because it is saturated and waterlogged just as sawdust will float lower in the water than an equal mass of solid wood. The fact that these anchor ice masses float lower in the water than a similar weight of packed ice would, has given rise to the opinion that anchor ice was ice denser than normal and therefore held down by its own weight. The reason of anchor ice being fastened to the bottom is that it is actually frozen there. As evidence of its buoyancy, large masses of rock are sometimes brought up with the anchor ice and carried down the river. Anchor ice will carry large boulders which fill up the channel of the river, and that is one thing the Montreal harbor commissioners have to contend with. They have annually to remove a large amount of rock and boulder carried down by the anchor ice. This anchor ice when it comes up becomes disintegrated and is carried down with the currents, thus aiding the frazil in causing the damming up of the channel.

The problem set Dr. Barnes by the Harbor Commissioners was to determine if possible what were the relations between the temperature of the water, if any, and the formation of anchor ice on the bottom, and the peculiar agglomeration of frazil crystals that takes place during very cold weather. It is a great difficulty that the engineer has to contend with in clear water with wind agitation that these little harmless particles grow in size very rapidly and form hard masses to which other crystals immediately adhere. Under certain atmospheric conditions ice agglomerates very rapidly and objects placed in the water become rapidly coated with ice. It is a common phenomena that if one lowers a bit of iron or metal into the water when the water is in this state that the iron will freeze at once to the bottom or to whatever ice it comes in contact with.

A suitable form of resistance thermometer was designed and an investigation was undertaken to determine if possible any variation in temperature from the freezing point under the surface ice.

The method of observation which was adopted was a differential one, determining the temperature of the river by a difference from a carefully prepared mixture of ice and water. The difficulties encountered were very great, and although about five weeks were occupied in these measurements only half a dozen measurements could be obtained. It was found during the entire time, with a variation of air temperature from 28° below to 40° above, the river under the surface ice never varied as much as one one-hundredth of a degree from the freezing point. During the entire time of the observation no deviation as much as that could be measured and as a rule the variations were within a few thousandths of a degree. A severe spell of cold weather would cause a slight drop in temperature and vice versa.

Observations were made later at the Lachine Rapids because it was considered that possibly the water under the ice opposite the city came to the freezing point because it flowed so far under the surface sheet of ice. Measurements were carried out for about six weeks in this position and slightly greater variations were obtained than under the surface ice, but as far as the lowering of temperature was concerned it could be limited within one-hundredth of a degree Centigrade; and the greatest lowering of temperature observed during a very severe day was six thousandths of a degree.

The 72,000,000-Gal. Sewage Pumping Engine at Dorchester.

Pumping engine No. 5 of the main drainage works of Boston was designed by Dr. E. D. Leavitt, of Cambridgeport, Mass., consulting engineer, and built and erected by I. P. Morris Co., of Philadelphia, Pa. The construction of the engine is of the most massive character, with a triple-expansion beam and flywheel condensing engine of the Leavitt type, operating two single acting pumps.

The steam cylinders, 18½, 33 and 52¾ in. diameter, and of 120 in. stroke, are vertical and inverted; the pistons of the high pressure and intermediate cylinders being connected to one end of the beam, and that of the low pressure cylinder to the other end. The pumps are hung underneath the engine bedplates and additionally supported by adjusting screws which bear on girders built into the foundations. The two single-acting pump plungers, each 60 in. in diameter and of 120 in. stroke, are rigidly connected by rods to the two steam crossheads. The high pressure and intermediate pistons with their attached plunger make their upward stroke at the same time that the low pressure piston and its attached plunger are making their downward stroke, and vice versa.

The delivery chambers of the two pumps (each 12 ft. outside diameter by 11 ft. 8½ in. high) are connected together, and two discharge mains, 48 in. in diameter, lead in opposite directions, one from each pump.

Each pump consists of twelve principal castings, viz.: Four suction tubes leading to and bolted to four suction boxes to which the suction valve seats are bolted; one suction chamber, to which the suction boxes are bolted; one delivery seating, next above the suction chamber, to which the delivery valve seats are bolted; a delivery chamber made in two castings, forming also as air chamber.

The pump valves are rubber flaps with composition backing plates loaded with lead, and composition washer plates. The valve seats are of composition with inclined faces. Valve guards of composition are bolted to the seats. The plunger of each pump works in a long, composition-lined sleeve with an outside stuffing box.

The bedplate is made in several pieces; its length over all is 42 ft. and its width 16 ft. 3 in. The pedestals for the main-beam pin rest on a central transverse bedplate and are bolted to longitudinal bedplates which carry the engine columns. The cylinders, valve gear and main crank shaft bearing are carried on a massive entablature 14½ ft. wide and 31 ft. 2¼ in. long, made in several pieces, which is supported by four heavy columns with diagonal braces. There is an outboard bearing for the crankshaft, carried on an independent foundation pier. The cylinders are thoroughly steam-jacketed all over on the heads and barrels. The jacket walls are stopped off at the middle length of the cylinders and fitted with copper expansion rings. The steam valves are of the gridiron type, operated by cam valve gear. The cam shafts are driven from the crank shaft by a drag link, lay shaft and mitre gearing. All of the valve gear connections are made with hardened steel bushings and pins, ground to fit. All working parts of the valve gear, as well as the cam shaft pedestals, are finished bright.

Tubular reheaters reheat the steam on its way from the high pressure to the intermediate cylinder, and from the intermediate to the low pressure cylinder. The intermediate reheater is 3 ft. 3 in. inside diameter shell and 12 ft. between tube plates and contains 480 1-in. brass tubes. The low pressure reheater is 4 ft. 6½ in. inside diameter shell and 10 ft. 6 in. between tube plates, and contains 964 1-in. brass tubes.

All hot surfaces are thoroughly protected from radiation by non-conducting covering with a cast-iron and sheet steel lagging handsomely finished.

The condensing apparatus is hung from girders which span the pit adjoining the main pump well, and consist of a jet condenser with a vertical single-acting bucket air pump, 35 in. diameter bore, 24 in. stroke, driven by links and a rocket shaft from the main beam center.

The pumps hang in a wet well, from which they take direct suction. Screens are provided in the pump wells to catch solid material which may pass the sewer screens. The static head on the pumps, from the suction well to the deposit sewer, will ordinarily be about 37 ft., but may at times be as high as 43 ft. The dynamic head will be slightly greater. The normal speed of the engine is about 17 r.p.m., at which speed the pumping capacity by plunger displacement is about 72,000,000 gal. in twenty-four hours, about 3,000 gal. per revolution.

The working steam pressure is about 185 lb. per sq. in. above the atmosphere.

Cast-iron galleries, with suitable stairs and handrails, are provided for reaching all parts of the engine and pumps.

The height measured from the main engine house floor level to the highest point, the top of the intermediate lagging, is 36 ft. 4⅜ in., and to the lowest point (the bottom of suction tubes) is 34 ft. 3 in., thus making the total height of the pumping engine 70 ft. 7⅜ in.

On account of the massive construction of the machinery, the large size and great weight of the individual parts, its transportation required special facilities on account of some pieces being too large to ship by rail and therefore were shipped by water, a 1,500-ton barge being used. Some of the weights are as follows: Beams and pins, 50,000 lb. low pressure cylinder, 40,000 lb.; beam pedestal bedplate, 34,000 lb.; plunger, 30,000 lb.; upper pump chamber, 26,000 lb.; crank shaft, 23,000 lb.; delivery seating, 21,000 lb.; suction chamber, main columns and beams, each 17,000 lb.; the total weight being about 1,700,000 lb.

There being no crane in the engine house, it was necessary to erect the machinery with hand crabs, and the entire pumping engine was transported and erected without mishap of any description, there being no breakage of any of the parts nor injury to any workmen engaged in the work. The engine was put in operation on Feb. 11.

THE CENTRAL HEATING SYSTEM of the Bloomington & Normal Railway, Electric & Heating Co., of Bloomington, Ill., now supplies hot water to about 83,000 sq. ft. of radiating surfaces in business and private buildings, which are on an average ¾ mile from the station. The Yaryan system is employed using exhaust steam, supplemented when necessary with live steam.

A Notable Engine Test.

The Durham St. Weaving Co., Ltd., of Belfast, Ireland, has a compound engine using superheated steam supplied by a Lancashire boiler and an independently fired Schmidt superheater. The engine was built by Cole, Marchent & Morley and was recently tested by Messrs. M. Longridge, J. Taylor, J. B. Gow and H. M. Longridge, of the British Engine, Boiler & Electrical Insurance Co.

The engine was an inverted vertical compound of the marine type, with unjacketed cylinders nominally 21 in. and 36 in. diameter by 3 ft. stroke, each having four piston valves, viz., one at each end to admit steam, and one at each end for exhaust. The steam valves were opened by eccentrics and closed by springs through a Dobson trip gear, the cut-off on the high-pressure cylinder being controlled by the governor, and on the low-pressure by hand. The exhaust valves were opened and closed by eccentrics. The builders of the engine informed "The Engineer," of London, that the Corliss valve has been found unsuited, in their experience, to any temperature above 500° Fahr. A fact that shows the utility of piston valves for high temperature was observed on the day preceding the trials. The pyrometer on the superheater stuck at about 650° and the fireman accordingly ran his fires so hard that the covering of the steam piping smoked. A thermometer was then placed in a pocket in the stop valve of the engine, which read 840° Fahr., but the remarkable results mentioned below were nevertheless obtained a day later. The following notes are given in the language of the report.

TEST OF A 500-H.P. VERTICAL CROSS-COMPOUND MILL ENGINE AT BELFAST.

The volumes swept by the pistons per stroke were 7.05 and 21.06 cu. ft. for the high and low-pressure cylinders. The cylinder ratio is 1:2.984. The clearance is 8.7 and 9.4 per cent. in the high and low-pressure cylinders. The receiver volume, including piping to cylinders and waste space in valve boxes, is 28.05 cu. ft.

Number of trial	I.	II.	III.	IV.	V.	VI.
1. Duration of trial, hours	1.842	1.854	1.961	0.5277	1.408	0.90
2. Atmospheric pressure by aneroid barometer, lb. per sq. in.	14.66	14.5	14.4	14.4	14.4	14.4
Steam.						
3. Weight entering high-pressure cylinder per hour, lb.	4379	4272	3088	1272	2863	2240
4. Condensed steam drained from reheater per hour, lb.	0	0	0	0	0	0
5. Pressure by gauge on boiler side of engine stop valve, lb. per sq. in.	117.5	117.5	117.5	114.5	117	114.5
6. Temperature of steam boiler side of engine stop valve, deg. Fah.	743	738	749	726	751	732
7. Superheat of steam boiler side of engine stop valve, deg. Fah.	395	390	401	378	403	384
8. Temperature of steam entering high-pressure cylinder, deg. Fah.	601	590	569	550	580	558
9. Superheat of steam entering high-pressure cylinder, deg. Fah.	253	242	221	202	232	210
10. Drainage from pipe between cylinders per hour lb.	0	0	0	0	0	0
Exhaust Steam.						
11. Temperature at exit from engine, deg. Fah	120	117	104	110	97.5	93
12. Temperature of water leaving hot well, deg. Fah.	102	101	78	70	71	64
13. Vacuum gauge, in. of mercury	26.4	26.4	27.0	26.5	27.4	27.4
Power.						
14. Mean effective pressure in high-pressure cylinder from mean diagram, lb. per sq. in.	41.4	41.25	32.6	13.63	31.4	24.25
Corresponding indicated horse-power developed in high-pressure cylinder, I.H.P.	256.2	255.6	201.8	84.5	194.6	150.2
Mean effective pressure in high-pressure cylinder by planimeter from actual diagrams, lb. per sq. in.	41.5	41.6	32.6	13.85	31.4	24.1
Corresponding indicated horse-power developed in high-pressure cylinder, I.H.P.	256.9	257.7	201.8	85.8	194.6	149.3
Mean effective pressure in low-pressure cylinder from mean diagram, lb. per sq. in.	12.18	11.12	7.89	3.33	7.51	5.83
Corresponding indicated horse-power developed in low-pressure cylinder, I.H.P.	225.1	205.5	145.7	61.6	138.9	107.8
Mean effective pressure in low-pressure cylinder by planimeter from actual diagrams, lbs. per sq. in.	12.14	11.08	7.91	3.30	7.5	5.83
Corresponding indicated horse-power developed in low-pressure cylinder, I.H.P.	224.3	204.8	146.0	61.0	138.7	107.8
15. Mean pressures referred to low-pressure cylinder from mean diagrams, lb. per sq. in.	26.06	24.94	18.81	7.87	18.04	14.38
16. Mean area of low-pressure cylinder, sq. in.	1010	1010	1010	1010	1010	1010
17. Revolutions (by counter)	100.6	100.7	100.6	100.7	100.7	100.7
18. Piston speed in low-pressure cylinder per minute, ft. per min.	603.6	604.2	603.6	604.2	604.2	604.2
19. Indicated horse-power	481.3	461.1	347.5	145.5	333.5	258.0

Heat Account (from 32 deg. Fah.) in B.T.U.

	B.T.U.	Per cent.	B.T.U.	Per cent.	B.T.U.	Per cent.	B.T.U.	Per cent.	B,T.U.	Per cent.	B.T.U.	Per cent.
20. Gross heat supply entering engine per minute	100,540	100.0	97,890	100.0	71,060	100.0	65,790	100.0	51,230	100.0	29,040	100.0
21. Heat equivalent of indicated horse-power per minute	20,410	20.3	19,550	19.98	14,734	20.7	14,140	21.5	10,940	21.4	6,170	21.2
22. Heat leaving engine in exhaust steam per minute, and 23. Balance of heat account, errors of observation, losses by radiation, etc., per minute	80,130	79.7	78,340	80.02	56,330	79.3	51,650	78.5	40,290	78.6	22,870	78.8

Deductions (Reckoned from Hot-well Temperature).

	I.	II.	III.	IV.	V.	VI.
24. Heat supplied per minute per indicated horse-power, B.T.U.	198.25	201.7	197.6	192.1	194.0	194.0
25. Work actually obtained for 1 lb. of steam, ft.-lb.	217,700	213,700	222,800	230,600	228,000	226,500
26. Thermal efficiency, per cent.	21.39	21.02	21.46	22.07	21.86	21.86
27. Heat theoretically required per minute by the Institution of Civil Engineers' standard of comparison per indicated horse-power (Rankine's cycle), B.T.U.	142.4	142.5	130.2	128.0	126.0	128.5
28. Maximum work theoretically obtained from 1 lb. of steam working in a Rankine ideal engine between the limits of temperature given in lines 111a and 106, ft.-lb.	303,400	301,800	337,600	344,600	349,300	340,700
29. Efficiency ratio	0.72	0.71	0.66	0.67	0.65	0.66
30. Thermodynamic efficiency of engine	0.72	0.71	0.66	0.67	0.65	0.66
31. Pounds of steam used per indicated horse-power per hour, lb.	9.098	9.267	8.886	8.585	8.682	8.742
32. Equivalent consumption of saturated steam reckoned from temperature of hot-well, lb.	10.63	10.81	10.38	10.03	10.07	10.12

The steam was supplied by a Lancashire boiler, and superheated in an independently fired Schmidt superheater, containing 1,033 sq. ft. of surface and exposed to the gases and 11½ sq. ft. of fire grate.

From the superheater the steam was carried to the engine-house by about 16 ft. of 8-in. cast-iron pipe, 78 ft. of 7-in. cast-iron pipe, 12 ft. of 7-in. mild steel pipe, and 15 ft. of 6-in. mild steel pipe. The pipes were covered with alternate layers of asbestos and hair felt to a thickness of 4¾ in., cemented over a layer of magnesia cement ¼ in. thick. The total length of the pipe was about 121 ft., its internal surface about 222 sq. ft., its external surface about 264 sq. ft., and the external surface of its covering about 576 sq. ft. The pipe was carried across the top of the boilers, through the stokehold, and across a covered yard open to the weather, to the engine house. Close to the engine it bifurcated, one branch leading through the tubes of a "hot-pot" or intermediate reheater, and the other through a bypass to the valve casing of the high-pressure cylinder.

A valve was provided for regulating the flow through the reheater, but this was left wide open during the trials, so that the steam passed freely through both channels.

The exhaust from the high-pressure cylinder was dried and superheated in the reheater before entering the low-pressure cylinder. Under ordinary working conditions the exhaust from the low-pressure cylinder was discharged into a jet condenser and Edwards air pump, 22 in. diameter by 14 in. stroke, driven by levers and links from the low-pressure piston rod crosshead; but during the trial it was led into a specially erected surface condenser, in order that the steam consumption might be ascertained by measurement of the air pump discharge. This condenser had about 1,200 sq. ft. of surface.

The air and circulating pumps were double-acting, direct driven, and were both 12 in. diameter by 12 in. maximum stroke. The stroke during the trials averaged about 11 in.

The discharge from the hot well was led alternately to one or the other of two tanks standing on weighing machines and weighed.

In all six trials were made—two at the maximum load which could be put upon the engine, two at about three-quarters, one at rather more than half load, and one at the lightest possible load, viz., when the engine was driving the mill shafting only.

The results of the trials are tabulated as nearly as possible in the form prescribed by the Committee of the Institution of Civil Engineers on "Tabulating the Results of Steam Engine and Boiler Trials."

In connection with these figures the following explanations may be given:

The cylinder diameters were furnished by the makers as the results of gauging at a temperature of about 60° F. The diameters were, of course, greater when the engines were at work, but the uncertainty as to the mean temperatures of the metal and the coefficients of expansion render the proper corrections for temperature so uncertain that it seems best not to make any, but to give the actual measured diameters. Even if it were assumed that the mean temperature of the metal in each cylinder were the mean of the temperatures during admission and exhaust, the corrections in piston displacements would be less than 1 per cent. of the same volumes calculated from the tabulated diameters and strokes. The error involved in omitting the correction is therefore very small.

Line 3.—As one of the conditions of the guarantee of consumption given by the makers was that the temperature of the steam at the stop valve should not be less than 700° F., and as this temperature was not attained till some time after each stoppage, and particularly after the stoppage for breakfast, the duration of the trials was limited. The light load trial was made during the three-quarters hour allowed for dinner, and was consequently very short. The time of beginning and ending could be taken by an ordinary watch to within a quarter of a minute; consequently it is evident that so far as it was affected by time, the error due to shortness of the trial would not exceed 1 per cent., even in the half-hour trial, and much less in the full load trials.

Line 3.—As all the drain cocks were kept shut during the trials, and as the packings of the condenser tubes were proved to be tight, the weight of steam entering the engine was equal to the weight of the discharge from the hot well. This was received and weighed in two tanks placed on weighing machines. The tanks measured about 2 ft. 11¾ in. by 4 ft. ¼ in. by 2 ft. 6¼ in., and were used alternately, one being filled while the other was being emptied. The weighing machines were new made, set in position, and tested by Messrs. Avery & Co., of Birmingham. With 9 cwt. of water in each tank, about a wineglassful of water easily lifted the lever. The arrangement worked admirably, and the measurement of steam used may be considered accurate to within a small fraction of 1 per cent.

An inspection of the water lines shows some irregularity in the rate of discharge from the hot well, particularly in Trials V and VI. This is partly due to variation of load, but partly also to the arrangement of the pipe leading from the hot well to the measuring tanks.

Line 7.—The temperatures of the steam as it passed through the engine were measured by mercury thermometers placed in pockets filled with oil screwed into the steam pipes. The two thermometers used for measuring the temperature of the steam entering the receiver and high-pressure cylinder were tested on the completion of the trials at the National Physical Laboratory, and the small corrections found necessary have been applied to the readings.

Lines 14-19.—The mean effective pressures and indicated horse-powers were calculated from indicator diagrams taken at intervals of ten minutes from indicator cocks connected to the cylinder ends by short bends. Four Crosby indicators were used.

The springs were said to be correct when hot, and the report states that they probably are nearly so. The cords connecting the indicators to the motions were less than 2 ft. long. From the diagrams taken at the trials the mean diagrams were constructed. The mean effective pressures calculated from these by the method of ordinates as well as the mean effective pressure calculated from the original diagrams by planimeter measurements are given in the table. The close accordance of the two measurements is strong evidence of the accuracy of the measurements.

Line 24.—In calculating the heat supplied to the engine, the specific heat of superheated steam at about 740° and 117 lb. pressure has been taken at 0.48 in accordance with the diagram plotted by Robert H. Smith, from the experiments of Professor H. Lorenz, and published in "The Engineer" for July 6, 1904.

Line 26.—The thermal efficiencies are obtained by comparing the number 42.41, which is the heat equivalent of the horse-power per minute, with the heat supplied to the engine per minute. The ratio shows what percentage of the heat supplied is converted into work.

Lines 27 and 29.—The heat theoretically required by the Institution of Civil Engineers' standards of comparison is the heat required by an ideal engine, described by Rankine, when working between the temperatures given in lines 106 and 111a. It is the least quantity of heat which an ideal steam engine working on this cycle would require. A comparison of the number 42.41 with this minimum quantity of heat gives the "thermal efficiency" of the ideal engine, and a comparison of the "thermal efficiencies" of the ideal engine with that of the actual engine gives "the efficiency ratio"; that is, the ratio between the heat actually used and the smallest quantity of heat which could be used in an engine without clearance or permeable cylinder walls working between the same temperatures as the actual engine.

Line 31.—The figures on this line are somewhat irregular. The difference of .168 lb. between the consumptions in Trials I and II, and of .301 lb. between the consumptions in Trials III and IV, may be partly accounted for by the slight excess of superheat in Trial I as compared with Trial II, and in Trial IV as compared with Trial III; but they are probably due for the most part to error in the indicator diagrams, for it is hardly possible that the water and time measurements could be so far out.

Taking the means of these experiments, it may be said that the steam consumption per indicated horse-power per hour, and the heat consumption per indicated horse-power per minute, were as follows:

For 471 I.H.P.......9.187 lb. and 199.7 B. t. u.
" 341 " ....8.735 " " 194.9 "
" 258 " ....8.682 " " 194.0 "
" 145 " ....8.742 " " 194.0 "

Line 32.—The weights in this line were found by multiplying the weights in line 31 by the quantities of heat required to raise them from the temperature of the hot well to evaporate them and to superheat them, and dividing the products by the quantities of heat required to raise 1 lb. of water from the temperature of the hot well, and to evaporate it into saturated steam at the boiler pressure.

In considering the economical result the mill owner should look at these figures rather than those in line 31. Indeed, he must look further still, for these figures take no account of the loss of heat by radiation from the steam pipe, or of the heat which was absorbed by the brickwork of the superheater at the commencement of each run and dissipated at the end. If the temperature gauge upon the superheater was approximately correct, the fall in the temperature of the steam in passing from the superheater to the engine stop valve varied from 70° to 100°, according to the weather. The heat lost in this way from 9 lb. of steam was sufficient to evaporate from 0.3 lb. to 0.4 lb. of water. The heat absorbed by the brickwork of the superheater and given out uselessly during the meal hours and the night must have been sufficient to have evaporated at least twice as much, so that in comparing the financial results with those obtainable from a saturated steam plant the figures given in line 32 should be increased by 10 per cent. at least.

The engine was said to have been at work nearly a year. During the trials it ran most satisfactorily, without a leak anywhere, and with every bearing dead cold. After stopping, one of the high-pressure steam valves was taken out, and both the packing rings and the liner in which it worked were found in perfect condition. No trouble need be anticipated from the effects of the high superheat upon the valves, and unless the stop valve gives trouble, which seems improbable, it is difficult to see where trouble can occur, since once inside the cylinder, the steam will not be much hotter than in engines using high-pressure saturated steam. What the effect of the high temperature may be upon the tubes of the superheater time alone can tell. No trouble has been experienced with them as yet.

A REMARKABLE MACHINING OPERATION was witnessed recently at the shops of the Vulcan Iron Works, at Wilkesbarre, Pa., in the performance of six operations simpltaneously upon a large 42 x 60-in. cylinder casting with piston-valve chamber cast integral with it, for a large mine hoisting engine. The casting was placed in a special boring machine with two boring spindles, one of which was boring out the cylinder with a ⅛ x 1-in. cut, and the other the piston valve chamber; facing cuts were also carried out simultaneously on both ends of the cylinder and valve chamber. The time required for finishing was in this way reduced to less than one-quarter of that with former machining methods.

The Accident in the Gunnison Tunnel

Considerable attention has been paid by the newspapers to a recent accident in the Gunnison tunnel near Montrose, Colo., and for this reason the following notes based on official reports are printed here. The work is being done for one of the irrigation projects of the U. S. Reclamation Service. The work was being done in dangerous ground, saturated with water, and the accident seems to have been one of those occurrences which inevitably occur in undertakings of this nature, no matter what precautions are taken.

The cavein occurred at 10:30 a. m. May 30, coming in upon the shift of workmen who had gone on at seven o'clock. The men were distributed at various kinds of work all along the tunnel, which is 675 ft. in length. They were putting the permanent timbers in place, closing up the three divisions shown in the diagram. At 336 ft. from the portal a crew of men were laying the mudsills and arranging the timbers to put in the last 9-ft. set connecting the two divisions. Before the cavein the only warning given the men was a little sand trickling through the temporary timbers. A workman called to the men to get out instantly, but before they could scarcely move, they were caught in an avalanche of crushed timbers, mud and debris. Five men working just at the edge escaped. The trammer on a carload of dirt pulled by a horse had just passed this point when the rush of wind knocked him off the car and the latter was pushed off the track. A boy nearby ran toward the portal and the top of the incline, where a small hoister was located, and communicated the news of the catastrophe.

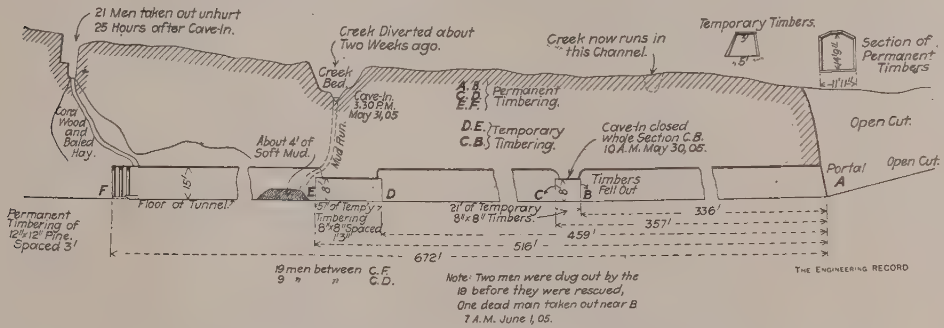


Diagram Showing Location of Cavein at the Gunnison Tunnel.

A short time after the cavein occurred the workmen on the outside heard taps on the pipe line and they answered immediately, receiving a second response, which indicated that at least some of the men behind the cavein were alive. No time was lost in sinking a temporary shaft down to the tunnel, a distance of about 50 ft. The men were changed every three minutes and the shaft seemingly went down with lightning rapidity. At 10:30 the next morning, just 24 hours after the accident occurred, an opening was made to the entombed men. Nineteen were found to be alive.

One man had been caught in the falling mass and remained under it for over nine hours. He happened to fall near the drainage trough and finally managed to extricate himself sufficiently to work down into this boxing. By pulling the dirt out, he worked his way along in the box until the edge of the debris was reached. His companions then assisted him out in a completely exhausted condition. Otherwise he was uninjured.

When another of the men recovered his senses after the first crash, he found he was holding the hand of someone. The dirt and mud were pretty tight about him, but he felt all right otherwise. He attempted to remove the dirt from his partner, following his arm up toward his face, but this was impossible, so he held his hand for what he believes was two hours, when the hand dropped limply and soon became cold. He began trying to dig himself out and finally worked into the drainage trough. By this time more mud and water had accumulated in the boxing and it was with the greatest difficulty that he could find room to move himself. He would stick his face down in the water and push ahead as long as he could hold his breath, then raise his face up long enough to breathe. This performance was repeated until he got within about 6 ft. of safety. He was then exhausted and could get no farther. He called for assistance and the entombed men came to the rescue. They pushed in a long bar of steel to him, which he grasped and they pulled him out.

The imprisoned men were working all the while, some constructing a dam across the bottom of the tunnel to hold the water, and others shoveling away the debris. They kept in good spirits, believing that succor would reach them before perishing. When reached they were standing in water up to their knees. As soon as they got to the surface, they all started to the portal entry, saying that they were going to aid in rescuing their companions.

Meanwhile every man who could find a spot to work in was in the tunnel shoveling debris into the cars. Little headway was made here, as the dirt came in as fast as taken out. It was fully a day before the ground could be held in place. While working there it was found that some were still alive under the debris, for their calls could be heard distinctly. By the next morning the party had gotten in far enough to converse with these men. They were pinned tightly, but were experiencing no pain other than the fatigue and distress of lying in one position. Every effort to release them proved futile, as the removal of a single timber might start another slide and certainly kill them. The men believed they could hold out and told the workers to take their time. Another day passed and still they could not be released. By the morning of June 1 the men were very weak, but nourishment was passed in to them through openings between the timbers. At one o'clock in the afternoon the timbers had been braced sufficiently to remove those which held one of the men and he was pulled out. He simply complained of stiffness and rheumatism and was exceedingly jovial all the time. Three hours later the second man was extricated by placing straps around his ankle and six men pulling him through an aperture which seemed scarcely large enough to accommodate his limbs. He was the weaker of the two, but stood the ordeal bravely.

On the afternoon of May 31 the bed of Cedar Creek, through which a very small stream of water was running, fell in and a quantity of mud ran into the tunnel at a point 615 ft. from the portal, or 60 ft. from the breast. It created considerable consternation, but did no great damage. This was 280 ft. from where the first cavein occurred.

The body of Ackerman was placed in the hands of Coronor Schermerhorn and will be held until the others are recovered, when an inquest will be held.

The men who have been rescued say that the cavein was one of those unavoidable accidents which occur in like enterprises. The temporary timbers where the cavein occurred were very strong and numerous, and when this ground was first passed through it did not show the slightest indication of sliding.

New York Subway Ventilation.

By Konrad Meier, Consulting Engineer, New York.

After seven months of regular operation under varying atmospheric conditions, it should be safe to pass judgment on the success or failure of the New York subway in respect to ventilation. There had been considerable apprehension regarding the quality of the air, primarily induced by abnormal conditions during the opening days and kept up through some ill-advised statements appearing in the daily press. Naturally, the opinions of laymen are formed by an individual or single point of view, and they cannot be expected to cover the situation broadly, and on its true merits. The subject, in a general sense, is one of sanitation; that is, it resolves itself into the practical application of hygienic principles to engineering work, and should therefore be discussed between engineers and hygienists.

The ventilation of the subway presents a compound problem, so to speak. We must secure wholesome air for the tunnel itself as well as for the interior of the cars. The proposition in this respect is similar to that of ventilating inside rooms, such as are dependent upon partially polluted air from other compartments, and therefore must be under a disadvantage. Of course, on the subway trains we have the advantage of effective use of transoms and doors, assisted greatly through the rapid motion of the trains. On the other hand, the air is already vitiated when entering the cars, generally less, but frequently more so than that which it replaces. Such ventilation is a delusion; in engineering terms it might be called a short-circuit, or a drop in efficiency. It is merely circulation, not ventilation.

The only remedy for this condition can lie in active interchange of air between the tunnel and the street. Whether or not this takes place sufficiently may be estimated in several ways: first, by the odor and quality of the air in any part not affected by draughts across the stations; second, by the actual rate of discharge through openings; third, by differences in temperature; fourth, by chemical tests as indicating the vitiation due to crowding.

When meeting an outgoing current of air at subway entrances we notice not only the odor of machinery, but also a certain stuffiness, more or less pronounced, according to the weather and the time of day. Generally, this exhaust is as foul as the air we meet when entering crowded cars or untidy buildings. The waiting spaces are benefited considerably by the indraught from the street, but each train brings a whiff or sample from the interior, which is distinctly worse than that at the entrances. For the quality in cars we have no direct means of comparison with the outer air, as one becomes inured to the change while waiting for a train. When we consider the sources contributing to it, the pollution of the large volume of air contained in the tunnel cannot be very rapid, hence the quality of the air in itself would point to a slow renewal.

The rate of discharge through the present openings depends upon various factors—differences of temperature, wind action and the movement of the trains. Assuming the space per capita to be about 1,000 cu. ft. when the subway is moderately crowded, two changes of this volume per hour would supply 2,000 cu. ft. for each passenger. This is a liberal quota for schoolrooms, but on account of its necessarily very unequal distribution, especially in the cars, it must be considered as a very moderate allowance in this case. A rough calculation of the air velocities resulting from such a renewal shows that they would have to average from 6 to 8 ft. per second at the 144 openings. Such velocities can now be observed only at intervals, when the wind happens to be favorable. The ingoing currents at such times, however, do not represent the rate of renewal in the tunnel itself, but rather the cross-draughts at stations. For the interior reaches we depend practically upon the movement induced by the trains. This seems to be over-estimated, since no piston action can take place when the cross-sectional area of the tunnel is more than four times as large as that of a car front. The trains only create a momentary impetus by friction, frequently neutralized by another one in opposite direction. To judge, then, by the ingress and discharge, it would appear that the rate of renewal falls short of a most conservative requirement.

The decided difference in temperature between street and subway, amounting to 20° F. and more in cold and breezy weather, is another strong evidence of the comparative stagnancy existing. These differences would not occur under active ventilation. The temperature within cars also averages from 2° to 5° higher than that without, according to traffic, and shows that in the cars the air must be considerably more vitiated. In warmer weather, especially when the outside temperature is rising, the subway air is colder than the street air and the tendency of the former to rise will no longer exist. Under these conditions, what little air enters is being cooled. This cooling effect involves a rise in relative humidity, and combined with the hygroscopic dust this will create an unwholesome atmosphere within, which is aggravated by the greater stagnancy during the summer season.

In his preliminary report to the Board of Health, familiar enough through its publication in pamphlet form by the Interborough Company, Prof. Chandler states that he found the average percentage of oxygen to be 20.76 per cent. and 20.55 per cent., respectively, for nine samples of street air and fifty samples of subway air taken from the extreme ends of the station platforms. Accepting these figures as correct and applying his own statement, that "the amount of oxygen present is a sufficient indication of the absence of any appreciable quantity of carbon-dioxide," we can calculate the amount of the latter by the respiratory quotient for man and find $(20.76 - 20.55) \times 0.87 + 0.04 = 22$ parts in 10,000. An atatmosphere contains 4 parts in 10,000. An atmosphere charged with more than 10 parts in 10,000 is generally regarded as undesirable for breathing, even though people will often put up with considerably more. Prof. Chandler's findings, therefore, would strongly confirm the assertion that fresh air does not enter and leave the subway freely enough to dilute the impurities to a reasonable degree.

Since the distribution of the pamphlet mentioned, some tests were made on carbonic acid. These figures as far as given to the press show an average of only 5.67 parts in 10,000, but of 19 samples examined, all were taken before 2 o'clock P. M., and less than one-half of them during the busy hours of the forenoon. None were taken toward the end of the day's travel, when the air is always worse. The discrepancy in the results of these tests might therefore explain itself. Again the samples only represent the air at stations, none being taken from the tunnel itself or from within the cars. A fair investigation should cover average and extreme conditions maintaining, in stations as well as in the midway between, and in crowded cars, under different atmospheric conditions. Such tests would be of value as indicating the relative pollution by crowding, and would give further points in judging the comparative efficiency, or inefficiency, of the present means to ventilate.

The foregoing observations should be sufficient proof that even in favorable weather the exchange of air is too slow, particularly during and after the rush hours when the subway is charged with dust from the traffic and generally untidy from use. Indeed, the quality of the air can be distinctly traced to correspond in a measure to the salubrity maintaining at different times and places. This fact leads to the conclusion that the dust and dirt brought into the subway by passengers and in other ways, also that created by the wear and tear on rolling stock, is a considerable source of pollution, not indicated by carbonic acid tests, but nevertheless important. This item is now unduly increased through the impossibility of properly cleaning the system, except as to its most accessible and conspicuous parts. It was a grave mistake from a hygienic point of view to use broken stone for the road surface. Its capacity for dust is only limited by the stirring up through the train motion. Sprinkling would make it foul. Scouring or flushing are impracticable. The dirty aspect of the roadway invites spitting, and refuse is very apt to be swept onto it inadvertently. Likewise, too, little attention was paid to modern sanitary principles in designing the cars. There are too many inaccessible corners and opportunities for dust to collect.

If the air of the subway shall be as "pure as in your own home" we must keep its interior and equipment as tidy and clean as would be demanded in buildings. The trains cannot be considered as running in the open air. Aside from the stations, the underground route is less subject to natural ventilation than the average dwelling, its inlets and outlets being from 1,200 to 2,000 feet apart, with no decided tendency for longitudinal draught between them. The spontaneous ventilation due to leakage through walls and windows, often a saving feature in structures above ground, is missing here altogether, and is only in part made up by the openings provided.

Considering these facts, we cannot but reach the conclusion that the provisions for ventilating the subway are now inadequate. The present situation can be improved in two directions: by preventing vitiation as far as possible and by accelerating the air renewal.

Strict salubrity will certainly prevent much of the pollution of the air by dust and dirt and its undue contamination by bacteria. There should be systematic cleaning, if possible by mechanical devices, and frequent disinfection.

Bacteria do not "breed" in the subway air, whether dry or moist, but they will "accumulate" with the dust. Unless the means are provided to remove this thoroughly and to keep the tunnel clean, they will gradually become a menace to public health, particularly in times when grip or other diseases communicated by air have become epidemic. In contact with water the microbes are harmless enough, because unable to reach their victims, but when stirred up from the dusty roadbed by the trains, we will certainly be obliged to breathe a much greater number than in the open air or in dwellings, and the chances for infection are correspondingly more frequent. While exhausted air is debilitating, its effect on passengers during a short ride is not of much consequence; but the pathogenic microbes inhaled may stay in the respiratory tract for days and develop under certain conditions, for instance when in contact with inflamed mucous membrane, due to irritation or colds. Persons so afflicted are naturally exposed to more serious attacks of disease. The numerous deposits of sputum seen everywhere bear ample testimony to the prevalence of chronic inflammation or colds and other ills traceable to the bad habit of expectorating, and the unsanitary surroundings now tolerated in large cities. The subway presents more opportunities for the spread of disease than most public buildings and conveyances. Greater vigilance should therefore be observed in regard to its sanitary condition. Unfortunately some important principles of hygiene have been disregarded in the construction of certain parts of the underground route which make it most difficult, if not impossible, for the management to maintain the proper standard of salubrity. The unavoidable usage of air due to the presence of mankind, also the odor and dust resulting from the operation of machinery, should be offset by ventilation, natural or artificial, as the case may demand. Since the spontaneous ventilation is not sufficient at present to maintain a reasonable standard of purity, we must either increase the facilities for ingress and egress of air, or resort to forced ventilation. More openings to the street can yet be provided in certain places and some of the present ones arranged to better advantage. We cannot have too many openings for natural ventilation. In some sections not otherwise reached it may be necessary to create the desired movement of air by mechanical means. Evidently, the requirements of the subway in regard to ventilation, or the efficacy of the means provided, have been underestimated by the designers and the facilities for air renewal are now decidedly inadequate.

The situation ought to receive attention by the engineers of the Rapid Transit Commission, who should take steps to improve the present conditions and to apply the results of this experience to the work now under way.

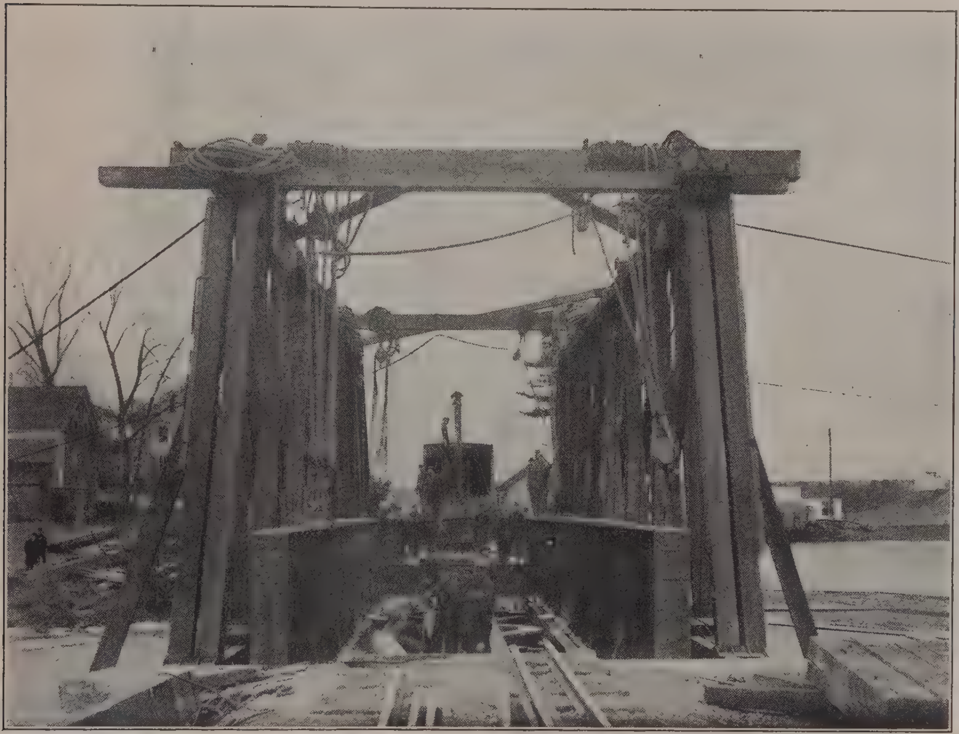
Classification of Excavation.

The classification of excavation causes so much trouble at times and is made in so many ways, that it is of interest to notice the system adopted for the main canal of the North Platte project of the U. S. Reclamation Service, involving 2,800,000 cu. yd. of earthwork and 150,000 cu. yd. of rockwork. Four classes have been adopted, as follows: Class 1: All material that can be plowed by an average four-horse or mule team, each animal weighing not less than 1,400 pounds, attached to a suitable breaking plow, all well handled by at least three men. Also all loose material occurring in the above that can be loaded into a scraper by two men. Class 2: Indurated material of all kinds which cannot be plowed as in Class 1, but which requires loosening by powder and can then be removed in scrapers, and including the formation known as Brule clay. Class 3: All loose material in which large rocks occur to such an extent as to prevent the use of plow or scraper, but excluding masses exceeding 1 cu. yd. in volume. Class 4: All rock in masses greater greater than 1 cu. yd. and requiring drilling and blasting.

SUCTION DREDGER NOZZLES give the best results when working in sand when they have such a form that they tend to bed themselves in the bottom. According to "Engineering," the suction at the nozzle acts normally to make a cavity in the sand and allow an unnecessary amount of water to enter the pipe. The experience at the Liverpool bar has led to the use of a nozzle that works its way into the sand, and is always covered with enough material to keep the ratio of water to sand handled by the pumps a low one.

Replacing a Howe Truss Span with Plate Girders.

A single track 76 ft. span Howe truss bridge at Wilsonville, Conn., on the New York, New Haven & Hartford R. R., was recently replaced by a through plate girder span on the same abutments without materially interrupting the traffic, and without the use of any derricks, gin poles, gallows, frames or falsework. The old through trusses were 19 ft. deep and 13 ft. apart on centers and had wooden floorbeams suspended below the bottom chords, thus bringing the rail-level about flush with the tops of the chords and at the height of the abutment coping. The new span is 14½ ft. center to center, and the girder bearings are 3 ft. 2 in. below the rail base, so that it cleared the old trusses, but required new seats on the old masonry. The end panels of the track were supported on blocking and part of the old floor removed, so that opportunity was afforded to prepare the new girder seats while traffic was maintained on the old bridge, and when all was in readiness an interval of 55 minutes between trains—one Saturday afternoon was selected—and the two new girders, loaded side by side on the same pair of cars, were brought on the bridge and lifted clear of the cars by four six-part tackles suspended from temporary transverse timbers laid across the ends of the old top chords.



Erection of New Girders from Old Trusses and Floorbeams with Derrick Car.

The fall lines of all the tackles were led to a four-spool hoisting engine located on shore beyond one end of the span, and after the girders were suspended in the tackles the cars were removed. The tackles were then slacked off, lowering the girders to position on their new seats, as shown in the illustration, the old Howe trusses being temporarily braced by inclined posts on the outside at each end. The floorbeams and stringers had been delivered at one end of the bridge, and were immediately assembled to the girders by a derrick car which passed through the bridge as the panels were successively completed. All holes were filled with service bolts, the track was laid on the new stringers, and the new span was ready for trains in 3 hours and 45 minutes after the last train passed over the old bridge. A riveting gang drove the field rivets by hand, and the old trusses were revolved about their lower chords and dropped to the river below, whence they were towed to shallow water and disconnected. The new girders are 76 ft. long back to back of end angles, 7 ft. ¼ in. deep back to back of angles, and weigh about 44,000 lb. each. They were designed under the direction of Colin M. Ingersoll, chief engineer of the railroad company, and were built and erected by Lewis F. Shoemaker & Co., Schuylkill Bridge Works, Philadelphia, Pa., and Pottstown, Pa.

Grand River Reinforced Concrete Bridge, Grand Rapids, Mich.

A reinforced concrete highway bridge, which has five arches that are designed to act as elastic structures fixed at both ends, with three-centered segmental intrados curves and single-centered extrados curves, has recently been built over the Grand River at Grand Rapids, Mich. The design and construction of the bridge were described in a paper before the Michigan Engineering Society by Mr. P. M. Louwerse, who stated that the center arch has an 87-ft. span, is 1 ft. 8 in. thick at the crown, 3 ft. 3 in. thick at the skewbacks, and has a 12-ft. 3-in. rise. The two intermediate arches have 83-ft. spans, are 1 ft. 7 in. thick at the crown, 3 ft. 1½ in. thick at the skewbacks and have a rise of 11 ft. 7 in. The end arches have 79-ft. spans, are 1½ ft. thick at the crown, 3 ft. thick at the skewbacks and have a rise of 11 ft.

The reinforcing of the arch rings consists of pairs of 1¼-in. Thacher bars, one bar of each pair placed 3 in. from the intrados and the other 3 in. from the extrados of the arch. The outside pairs are 3 in. from the face of the arch and the remaining pairs are on 14-in. centers. The bars were anchored in the abutments and piers by 3-in. washers and nuts and connected with the bars in the abutments and piers by turnbuckles, making the reinforcement continuous for each span. The lower rods of the pairs were blocked up in place from the lagging of the centers, while the upper rods were held in position by ⅝-in. rods about 4 ft. apart, connecting the upper and lower bars in the pairs.

The bridge carries a heavy highway traffic and the cars of an interurban electric railway and the following conditions were assumed in its design: The dead loads of the concrete in the bridge and of 12 in. of pavement were taken at 150 lb. per cu. ft.; earth filling 120 lb. per cu. ft.; live load, 10 ft. on each side of center line of roadway, 250 lb. per sq. ft.; remainder of 42-ft. roadway, 150 lb. per sq. ft.; 11-ft. sidewalk on each side, 100 lb. per sq. ft. A concentrated live load equal to a three-wheel, 15-ton steam road roller was also assumed. The modulus of elasticity of concrete was taken to be 1,500,000 lb. and of the steel 30,000,000 lb. The maximum compressive stress allowable on the concrete was 500 lb. per sq. in., with an additional allowance of 100 lb. per sq. in. for temperature stresses. The maximum tensile stress allowed on the concrete was 50 lb. per sq. in., with an additional 25 lb. per sq. in. for temperature stresses. The allowable shearing stress was assumed to be 75 lb. per sq. in. The reinforcing was designed to be capable of taking the entire bending movement of the arch without aid from the concrete and the actual stresses in it were not permitted to exceed twenty times the allowed stress on the concrete. The cross-sectional flange area of the steel was required to be not less than one one-hundred and fiftieth part of the total cross-sectional area of the arch at the crown.

The bridge was built on a rock foundation underlying a thin stratum of hard pan on the river bottom. Concrete was mixed on the river banks by two Smith mixers and carried out over the work in dump cars on a trestle track built longitudinally over the site. Work was started in June, 1903, and the 3,600 cu. yd. of concrete in the substructure to the springing lines of the arches was placed by the end of that season. Before the construction of the arch rings could be begun in the spring of 1904, an old steel bridge, which the new bridge replaced, had to be removed and a temporary footbridge built. The piling for the false work was driven as rapidly as the spans of the old bridge were removed. The falsework for each arch consisted of seven transverse rows of piles, seven in each row, thoroughly cross-braced by 2x10-in. plank. Each row of piles was capped by two 2x12-in. planks and by a 12x12-in. timber, with two oak wedges over each pile between the plank and timber, so the centering could be lowered without disturbing the falsework. Two-inch plank were placed longitudinally on edge on 16-in. centers over the 12x12-in. pile caps and bent and cut to conform to the intrados of the arch. The finished support for the arch consisted of 1x6-in. lagging nailed to the plank centering on the pile caps. The piles were driven for all five arches and the falsework completed for three of them at one end, the forms for two of these three being used again for the remaining arches.

The concrete was laid in transverse sections the full width of the arch forms, starting at the center section and working toward both ends of the arch. The length of the sections was such that the center section, or a pair of intermediate or end sections constituted a day's work and no two adjacent sections were laid on successive days. The concrete in which the bars near the intrados were imbedded was made with fine gravel mixed quite wet in the Smith mixers and worked into place with broad, flat rammers. A stiffer and coarser concrete, laid in layers not exceeding 6 in. thick, was used above the layer imbedding the lower row of bars.

The forms for the spandrel walls were erected on the first arches built, while the concrete was being placed in the last arches. These forms were braced from the centering for the arches and were made up of 2x6-in. uprights, on about 2-ft. centers, and 1x6-in. matched flooring. The arch ring was roughened by chipping holes in it where the spandrel walls were to rest and the forms smoothed and oiled before the concrete was placed. Expansion joints were formed at the springing lines and at one-sixth of the span from the springing lines by inserting two sheets of tar paper with a layer of tar between them. The top surface of the arches and the lower 6 in. of the inner face of the spandrel walls were given a heavy coating of semi-liquid mortar, consisting of one part thoroughly slacked lime, two parts Portland cement and six parts fine sand, spread to a smooth finish. When this waterproof coating had set hard a coating of neat cement grout was applied over it.

The space between the spandrel walls and over the abutments was filled with thoroughly rammed earth in 6-in. layers, to within 12 in. of the finished roadway. This filling varies from 10 ft. in depth at the piers to 6 in. deep at the crown of the arches, so a temporary pavement of broken stone and gravel was laid over the bridge until the filling had settled, before the permanent pavement was laid.

The keystones, brackets and balusters were cast in special molds during the winter previous to the construction of the arches in a building in which the temperature was kept above freezing. The concrete in them was made with very fine gravel, mixed earth damp and thoroughly tamped in the molds. The molds were removed as soon as the blocks were made and the perfect blocks placed on planks and sprinkled daily with water for two weeks. The remainder of the ornamental work was made in place in special molds, which were first plastered with facing mortar composed of one part Portland cement and two and one-half parts fine sharp sand and then filled with wet concrete consisting of one part Portland cement, two parts sand and three parts fine gravel. The work was smoothed, where necessary, by rubbing the concrete with a piece of wet sandstone after the forms had been removed.

The completed bridge, including sidewalks and pavements, cost about $100,000. Lehigh Portland cement was used exclusively with gravel and sand in the concrete, except in the lower part of the abutments. Mr. J. P. Rusche, of Grand Rapids, built the bridge and it was designed and its construction carried on under the direction of Mr. L. W. Anderson, city engineer of Grand Rapids.

Arrangement of Filter Beds and Operating Floor over Pipe Gallery, at Binghamton, N. Y.

Fire Protecting Coverings for Window and Door Openings.

While some progress has been made of late in the development of methods of protecting openings in the walls of buildings against fire, the National Fire Protection Association's committee specially intrusted with a study of this subject recently reported that far greater advancement must be made to place this engineering problem abreast with the times. Methods and materials are still being commonly used and approved which are unsuited for the purposes for which they are intended. The fire protection engineer and the insurance man may be partly to blame for this condition of affairs, but a large proportion of the blame must be attributed to the failure of the manufacturers to make progress in the advancement of their craft by the development of devices which will withstand actual fire service conditions rather than to rely alone on those which appear well under theoretical analyses. Costly experience has too often shown a lack of proper foresight in the failure to conclusively demonstrate the fire-resisting qualities of such devices before introducing them in service.

Recent tests and investigations indicate, the committee says, that for openings of ordinary size, the so-called standard tin-clad door and shutter, all things considered, furnishes the most reliable protection, particularly when the exposures are severe. The superiority of this type is very largely due to its efficiency as a non-conductor of heat. This offsets in a large measure inherent defects in other respects, such as the bulging of the plates by the gases generated from the inflammable materials now used in its construction, the falling down of the core after it has been reduced to charcoal, and its comparative lack of endurance under severe exposures. It is only fair to say that recent tests have shown that certain forms of doors have superior fire-retardant qualities to the tin-clad, wood-filled fire door, but their practicability in other respects has not as yet been fully demonstrated.

Doors and shutters having the desired fire-retardant qualities, a more acceptable appearance and in which no inflammable materials are used are urgently needed, and it is along the line of obtaining construction embodying these qualities that it would seem that the most effective progress could be made.

The standard vault door and the iron shutter would seem to take second place as fire retardants for general use, their most objectionable feature being the transmission of heat. When properly constructed retardants of this class are substantial, durable and capable of considerable variation in design. Combination with some incombustible material having the property of preventing radiation would seem to present the greatest possibilities in their further development.

Wired glass properly framed is classified as third on the list of retardants now in common use. Like thin iron shutters its most objectionable feature is due to the fact that where severely exposed the passage of heat through the glass is extreme. There is a vast field for the intelligent use of this most excellent material, but its limitations should be clearly recognized. A continuation of many of the present practices in its use will undoubtedly result in disaster and possibly in the discredit of its real value. Wired glass mounted in frames which are so poorly designed and constructed that they will hardly hold together until installed in the wall, and in frames which when heated are unable to withstand even the smaller jets from fire stream, will hardly prove of sufficient value to warrant the consideration with which they are now so commonly favored. The use of inflammable putty in which the glass is almost always set in itself constitutes a danger which is a serious menace under many conditions of service.

Polished plate and prism glass in units not exceeding 4 in. square, electro-glazed and properly framed should, in the committee's opinion, be classed with wired glass as a fire retardant.

Although not at present very generally used or recognized as a fire retardant the steel rolling door and shutter undoubtedly fills a valuable place in the list of retardants. It is classed next to wired glass and is best suited as a protection to exterior openings and where the exposures are moderate. Under some physical conditions it is the only retardant that can be used with any degree of effectiveness. Like the retardants made of thin iron and of glass, its greatest defect is due to radiation.

Another subject requiring attention is the preparation of rules for special design of fire retardants made necessary by the various unusual forms and sizes of wall openings now becoming so common. The practical nullification of the value of some forms of fire retardants by placing highly combustible curtains, wood trim, and even merchandise in close proximity to them must not be overlooked in installation work.

While the committee did not wish to advance these opinions as in any way final, it felt that exposures should be treated by the careful use of these retardants somewhat in the order of their mention, and this with a full appreciation of the limitations of the devices in question. It again called attention to some of the more important desirable qualities which should be embodied in fire retardants for the protection of door and window openings. The following general points are therefore mentioned:

1. They should be made of non-inflammable material.

2. They should be a good non-conductor of heat.

3. In addition to their fire-retardant qualities they should be able to resist the shock and force of fire streams.

4. They should be so constructed and mounted as to effectively cover the opening protected.

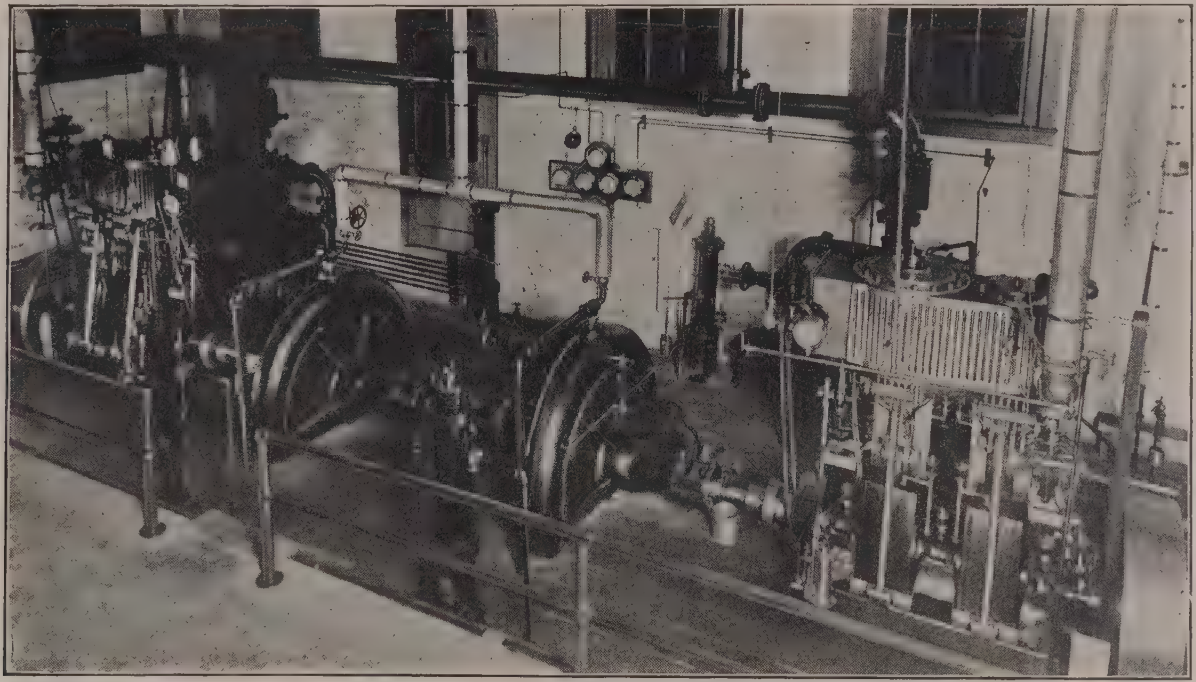
5. Their ultimate fire-resisting point should be nearly if not quite equal to the fusing point of the materials of which they are made.

6. They should be capable of withstanding the expansion due to heat and contraction due to rapid cooling.

7. They should be capable of resisting all reasonable blows from falling members.

8. They should be easy to operate, capable of being made automatic, acceptable in appearance and should not be prohibitive in price.

Compressed Peat is now produced at many places in the United States. At Lincoln Park, N. J., the Pompton Fuel Developing Co. uses German machinery in a small plant, selling its product locally. At New Rochelle, N. J., the Peat Koal Co. is operating another small German machine. At Orlando, Fla., briquettes are made on a machine designed by Mr. T. H. Leavitt, of Boston.



Centrifugal Pumps in the Filter Plant at Binghamton, N. Y.

Mechanical Filter at Binghamton, N. Y.

By George C. Whipple, Assoc. M. Am. Soc. C. E.

The city of Binghamton is situated in the south central part of New York State at the confluence of the Susquehanna and the Chenango Rivers. The population in 1900 was 39,647, but at the present time it is about 42,000. The public water supply is taken chiefly from the Susquehanna River a short distance above the city, but a part of it, perhaps one-fifth, is derived from wells located at the pumping station near the river. The system is that of direct pumping. There is no reservoir. There are three Holly pumps, two of 12,000,000-gal. capacity and one of 6,000,000-gal. capacity. The latter is soon to be replaced by a 12,000,000-gal. pump. The average consumption is about 7,000,000 gal. per day and the average head on the pumps is about 170 ft.

Partly for sanitary reasons and partly because the water of the Susquehanna River becomes at times quite turbid, a mechanical filter was installed in 1902 to purify all of the water supply of the city. This was constructed on general specifications prepared by the late Dr. Albert R. Leeds, of Stevens Institute. Bidders were required to submit their own plans and detailed specifications. The specifications called for a mechanical gravity filter with a daily capacity of 8,000,000 gal. and with provision for an increase to 10,000,000 gal. They required that the plant should be capable of furnishing a bright, clear and colorless water containing not more than 100 bacteria per cubic centimeter when the bacteria in the raw water were below 3,000 per cubic centimeter and not more than 3 per cent. of the number of bacteria in the raw water when that number was above 3,000 per cubic centimeter. They required also that the amount of wash water should not exceed 5 per cent. of the amount filtered. Nothing was said about the amount of alum to be used. The contract was awarded to the Norwood Engineering Co., of Florence, Mass., but certain minor portions of the work were done by a local contractor. The total cost of the filter, according to the report of the superintendent for the year 1902, was $86,292.

The filter is located near the pumping station in a 180 x 53-ft. brick building, with concrete foundation and a steel trussed slate roof. Light and heat are obtained from the pumping station. The building contains two sedimentation basins 40 x 24 ft. (capacity, 200,000 gal.), and twelve filter beds (each 21.5 x 15 ft.), arranged in two rows, with a pipe gallery, covered by an operating platform, between them. Both the sedimentation tanks and the filters are of concrete construction and their outer sides form a part of the foundation of the side walls of the building. Beneath the filters and extending outside the building is a pure water reservoir which has a capacity of 350,000 gal. The building also contains an engine room with two centrifugal pumps, the tanks and apparatus necessary for applying alum to the water, an air pump for supplying compressed air, besides a laboratory and an alum storage room.

The river water flows by gravity from the intake to what is known as the "long well," into which flows also the ground water which originally formed the entire supply of the city. The centrifugal pumps lift the water from this well to the sedimentation basins. On its way the water receives its dose of alum which flows by gravity from the solution tanks through valves regulated by hand. A butterfly valve controlled by a float prevents the sedimentation basin from overflowing.

From the sedimentation basin the coagulated water flows to the filters through valves controlled by floats to keep the water level on the filters approximately constant.

The filtering medium consists of 4 ft. of Red Wing sand, which had originally an effective size of 0.27 millimeter, but which later became as high as 0.60 on account of the loss of fine sand during washing. At the bottom of each filter there are 160 Wilson strainers, spaced 15 in. apart center to center. Each consists of slotted brass tubes radiating star-like from a central chamber. These are screwed into pipes leading to a main drain which discharges into the clear-water well below the filters. At the outlet of this pipe there is a controller to regulate the rate of filtration. This controller is so arranged that it can be opened wide at a moment's notice in case of fire, a matter of necessity on account of the small capacity of the clear-water well. Above and surrounding the strainers there are several inches of gravel and in this gravel are laid lines of slotted pipe through which compressed air is forced during the process of washing. From the clear-water well the water flows by gravity to the "round well," from which the pumps take their suction. The water used for washing the filters is now obtained from the city mains, its pressure being regulated by a pressure-reducing valve, but on account of the small size of the clear-water well, this has proved unsatisfactory and a special pump for washing the filter is being installed. Provision is made for wasting the first water that is filtered after washing.

On the completion of the plant the writer was engaged to test its efficiency. Two short runs were made in June, 1902, and in January, 1903, during which determinations were made of the rate of filtration, the amount of wash water, the amount of alum used, etc., while samples were analyzed several times a day in order to determine the efficiency of the filter. Between the dates mentioned samples of water were collected and analyzed at intervals of about one month.

The table gives a summary of the average results obtained during the two test periods.

Average Results Obtained with the Mechanical Filters at Binghamton, N. Y.

Date.	June 14-22, 1902.		Jan. 5-10, 1903.	
Quantity filtered (million gals. per day)	5.85		6.86	
Rate of filtration (million gals. per acre per day)	133.0		77.4	
Per cent. of wash water (including waste)	3.0		2.5	
Amount of alum (lbs. per million gallons)	97.		75.	
Number of filters used	9.		12.	
Physical Examination.	River Water.	Filtd. Water.	River Water.	Filtd. Water.
Temperature	71.2°F.	69.6°F.	35.6°F.	35.4
Turbidity	10.	0.	31.	0.2
Color	15.	6.	21.	3.
Odor	3v	2v	3v	1v
Chemical Analysis.				
Total solids	109.0	108.0	95.0	94.0
Loss on ignition	25.0	21.0	14.0	18.0
Fixed solids	84.0	87.0	81.0	76.0
Nitrogen as albumoid ammonia	0.104	0.058	0.102	0.048
Nitrogen as free ammonia	0.024	0.004	0.012	0.012
Nitrogen as nitrites	0.002	0.000	0.001	0.001
Nitrogen as nitrates	0.04	0.56	0.20	0.80
Chlorine	1.6	3.4	1.0	2.6
Hardness	55.0	68.5	36.5	54.5
Alkalinity	47.0	54.0	33.0	45.0
Iron	0.15	0.05	0.65	0.00
Free CO_2	0.3	2.3	—	—
Microscopical Examination.				
Microsp. organisms per cc.	48.0	0.	62.	2.
Bacteriological Examination.				
Number of bacteria per cc.	405.	28.	764.	58.
Percentage reduction	..	93.1%	—	93.4%
Test for B. coli	0.	0.	+	0.

It will be noticed that the figures for nitrates, chlorine, hardness and alkalinity were higher for the filtered water than for the river water. This was due not to the process of filtration, but to the admixture of the ground water with the river water before filtration. There was no opportunity to obtain samples of the mixed river and well water before the water received its dose of alum.

The difference in the quality of the river and well water is well shown by the following extracts from analyses made by the chemist of the Board in 1904:

	Parts per million— River water.	Well water.
Total solids	74.2	303.4
Silica	3.4	17.7
Alumina	0.9	0.3
Iron	0.05	0.05
SO_3	3.9	34.9
Chlorine	5.3	17.0
CaO	23.3	96.6
MgO	3.2	20.6
Nitrates	0.7	4.1

Since 1903 the analytical supervision of the filter has been in charge of Mr. Bert Nelson, of Binghamton, the chemist of the Board. His analyses are given in full in the annual reports of the Water Commissioners for the years 1903 and 1904. They show that during the year 1903 the average efficiency of the filter was 97.8 per cent. The numbers of bacteria in the river water varied from 450 to 20,000 per cubic centimeter, while in the filtered water they varied from 16 to 120 per cubic centimeter. Of the samples of river water 33 per cent. contained B. coli, but this organism was never found in the filtered water. The turbidity in the river water varied from 0 to 120 and in the filtered water from 0 to 5. The average amount of alum used is not stated, but it is understood to vary from one-half to one and one-half grains per gallon, i. e., from 70 to 210 lb. per million gallons.

In 1904 the efficiency of the filter was 99.0 per cent. The number of bacteria in the river water varied from 300 to 30,000 per cubic centimeter and in the filtered water from 7 to 95 per cubic centimeter. Of the samples of raw water 64 per cent. contained B. coli, but these were always absent from the filtered water. The turbidity of the raw water varied from 0 to 125, while the turbidity of the filtered water varied from 0 to 3.

The turbidity and color records given in the report are not as complete as could be desired, and there is good reason to believe that at times the turbidity rises to 500 or even higher. During the summer of 1902 turbidities higher than 300 were obtained on several occasions.

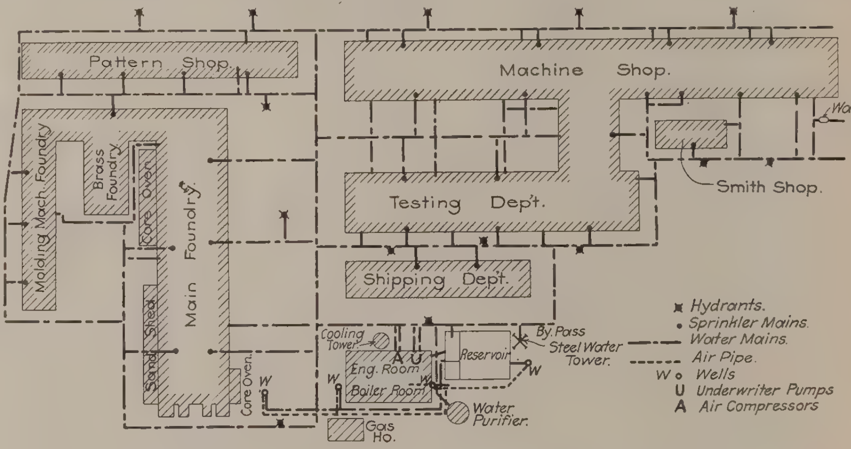
The annual reports do not give all the data necessary to a complete understanding of the processes of filtration as conducted at Binghamton or the cost of the same, but they indicate that the cost of operating the plant may be taken as approximately $6 per million gallons of water filtered.

More important than the analyses in showing the efficiency of the filter are the typhoid fever statistics of the city. From data obtained from the State Board of Health and from the local board it appears that for five years prior to the installation of the filter the average death rate from typhoid fever was 49 per 100,000, while for the last two years, during which the city has been supplied entirely with filtered water, the death rate has been only 11 per 100,000. From these figures it may be fairly assumed that 16 deaths and about 175 cases of typhoid fever have been prevented each year by reason of the use of filtered water.

The Diversion of Water beyond the watershed within which it originates has just been declared illegal by the Texas Supreme Court in Watkins Land Co. v. Clements. The decision is summarized in 86 S. W. Rep. 733, as follows: "A riparian proprietor cannot ordinarily divert water to irrigate land lying beyond the watershed of the stream, except where the drainage area is small and the supply of water abundant, so that other riparian owners will not be deprived of an ample supply. A riparian proprietor cannot sell water to others to irrigate nonriparian lands."

Fire Protection at the Worthington Works.

An example of modern practice in fire protection of industrial establishments is afforded by the new Henry R. Worthington hydraulic works at Harrison, N. J., described in this journal on Feb. 6, 13 and 20, 1904. This plant covers 34 acres of ground and contains 18 acres of floor space and accommodations for 5,000 men. The buildings of the plant are of brick and fireproof construction, with the exception of the pattern shop, which is of the "slow-burning" type. The diagram shows the complete pipe line system, the sprinkler and hydrant connections, and the location of the wells, reservoir, elevated tank, pumps and air compressors; also the connection with the city main. It will be noticed that the mains, which vary from 12 to 8 in. in diameter and have been tested to 200 lb. pressure, form loops around all the buildings and feed the interior piping at many points. Gate valves at different points in the mains make it possible to shut the water off from any part for repairs or other purposes without interfering with the protection of any building. Twenty-seven fire hydrants, with two and three openings each, are strategically distributed about the plant.



Arrangement of Fire Protection Mains, Worthington Hydraulic Works.

In the interiors of the buildings, hose reels and hand grenades are conveniently distributed, and the Grinnell system of overhead sprinklers with glass valve seats is installed with one sprinkler to every 20 sq. ft. of roof and ceiling. These valves open as soon as a temperature of 200 deg. F. is reached and distribute a strong horizontal spray in all directions. The discharge orifice is ½-in. in diameter. Half-inch nozzles and quick opening gate valves are used on the hose lines, which are 2 in. in diameter. Pressure gauges and automatic check valves are placed in the supply pipes or risers of the sprinkler system, and if the outside mains are broken on one side of a building, the check valves hold the water in the sprinkler system, which will still be supplied through the other connections to the mains. In addition, gate valves with indicator posts are placed in each connection from the mains to the risers.

In a system of protection, the water supply is an important factor. Indeed, the question of economical water supply for fire protection, the boiler plant and other uses, together with advantageous manufacturing and shipping facilities, settles the location of most extensive plants. A supply from the city mains may be altogether inadequate in time of need, and is in any case a source of constant expense. Before determining on the site, test wells were sunk which penetrated strata of disintegrated brownstone with a good supply of water at a depth of about 200 ft. An interesting fact is that the water is at first muddy, but soon becomes clear, at the same time increasing in quantity due to the washing out of crevices in the rock. The four wells of the Worthington plant pass through loam, sand and hardpan before entering a bed of gravel, and have an average depth of about 400 ft.

Water is raised by the air lift, which is peculiarly well adapted to scattered batteries of bored or drilled wells. It permits centralization of the power plant, as the air compressor may be located at any convenient point and the air piped to the wells. It also eliminates all valves, plungers and other moving parts from the well itself, thus doing away with the wear arising in other devices from sand and gravel. At the Worthington plant there are four of these wells within a 200-ft. radius, and having 8-in. casings, 5⅝-in. air and 4¾-in. flow pipes. One well discharges the mixture of air and water directly into the concrete basin or reservoir nearby. In the others the air and water discharge vertically from the flow pipe against an "umbrella," which allows the air to escape while diverting the water back into an open concrete basin from which it flows by gravity into the reservoir.

Air is supplied to the wells at a pressure of from 80 to 85 lb. by a Laidlaw-Dunn-Gordon compressor in the main power house, having a capacity of 800 cu. ft. of compressed air per minute. Ninety pounds pressure is required to start the wells, but 60 lb. will maintain the flow. When it is desirable to pump an unusual quantity of water, or stop this compressor, a larger Cincinnati-gear compressor by the same builders, which furnishes the air for the foundry, machine shop and other departments, may be employed.

The 500,000-gal. reservoir into which the wells discharge is of concrete 4 in. thick on a clay foundation, and is 121 ft. long, 104 ft. wide and 9 ft. deep in the center. At the right of the reservoir are three receiving basins, the first of which receives the discharge from the wells and overflows into the main reservoir. The middle basin is connected by a large screened passage to the main reservoir, and from it the underwriter fire pumps take their supply. The third small basin acts as an overflow for the main reservoir, and also supplies the water used by the pumps of the hydraulic elevator system, from which the water returns by gravity to this same basin. The basin overflows to the sewer.

From the reservoir, water can be raised to a 100,000-gal. steel tank on a steel tower by either of two Worthington underwriter pumps of 1,500-gal. capacity each. The tower is 135 ft. high and the tank 15 ft. deep, so that, as the tank is always kept filled, there is constantly on the service mains a head of 150 ft., creating a pressure of 65 lb. per sq. in. throughout the system. The standpipe leading to the elevated tank connects with the main fire line system through a check-valve and by-pass at the point where the discharge from the pumps enters the system. Ordinarily, the by-pass is left open and the pumps are controlled by an automatic pressure regulator to maintain a pressure equal to that due to the head in a full tank. In this way the pumps supply the water for daily consumption just as it is needed.

In case of fire, the water from both the tank and the pumps is available, but if a higher pressure should be wanted, the by-pass may be closed, and, if the capacity of the pumps is sufficient for the needs of the occasion, the check valve will also close, and a pressure of 150 lb. per square inch can be maintained by adjusting the regulating valves of the two underwriter pumps. If the pumps do not supply water as fast as it is used the check valve at the base of the water tower will allow water to flow into the mains from the tank. Should either of the underwriter pumps fail, the horse pump and the hydraulic elevator pump may be turned into the system, thus making complete stoppage of the fire system practically impossible. Yet, should such occur, there remains a connection through a water meter to the city mains which may be utilized to obtain 90 lb. pressure indefinitely.

Pipe Foundry Practice.

A paper read before the American Foundrymen's Association by J. B. Nau.

Some time ago the writer had an opportunity to take a trip through some of the most modern European foundries and noticed that in many respects these foreign foundries are ahead of American practice. This was more especially to be seen in pipe foundries.

The pipe specifications of Europe, while very strict and exacting in many ways, in fact, more so than in the United States, leave the manufacturer some latitude not enjoyed here. This is especially true in regard to the iron used. Whenever and wherever possible, for obvious reasons, the European manufacturer makes use of direct metal from the blast furnace. Of course, every precaution is taken to always obtain an even quality of iron by mixing the metals running from the different furnaces in special ladles; or in mixers of special design that can be run from one furnace to the other. The principal aim of the manufacturer is naturally to give full satisfaction to the buyer, who, as is proper, insists that the pipe bought should fill all the conditions of the specifications in regard to physical tests and strength of the metal. The buyer, on his side, insists simply on the pipe coming up to the specifications and leaves the manufacturer unhampered as to the source from which he should take his iron.

From long experience the manufacturer is well aware that he can satisfy all physical tests with iron whose analysis may vary within certain limits and that he can obtain the right quality, either by mixing the iron from different blast furnaces, or if necessary, by correcting this direct metal by admixing a certain amount of metal melted in the cupola. This item of quality is generally very carefully attended to and the pipes made, especially in some of the most important French and German plants, where the best working methods in other respects are employed, is invariably of good quality.

It can be readily understood that the use of liquid metal directly from the blast furnace is fraught with many difficulties, and its indiscriminate use is liable to produce pipes of uneven and uncertain quality. That this is so is well illustrated by the fact that the American pipe specifications, in order to eliminate the factor of uncertainty and of uneven quality, prohibits the use of direct metal in the manufacture of pipes, and specifically states that the iron should be remelted in a cupola or an air furnace. Of course, this remelting leaves no excuse to the manufacturer in regard to the quality of his iron, but still it has disadvantages that cannot be overlooked, one of which is the greatly increased cost of the iron when thus remelted. Another disadvantage lies in the danger of deteriorating the quality of the iron to some extent by increasing its sulphur content from the contact with fuel or flame. The best and cheapest way would naturally be to follow the practice already described, by mixing the different brands of irons running from the various blast furnaces, and if necessary, to correct the quality of the so mixed irons with irons remelted in the cupola. Such a proceeding, prohibited by American specifications, is only possible where the foundry is built near the blast furnace. Foundries not so located are naturally excluded.

In order to get all the benefit of the use of direct metal and avoid all the danger of uneven quality, the use of a heated mixer of sufficient capacity is here recommended. Since a few years ago, such mixers are being introduced in Europe in connection with steel works and they give the very best satisfaction. The writer had occasion to see one such heater of a capacity of 250 tons in a basic Bessemer steel works. It was heated with producer gas and provided with regenerators. Such a mixer is more to be considered in the nature of a gas-heated air furnace, with the exception that the iron instead of being melted in it, is brought liquid from the blast furnace and poured into the mixer, where it can be kept hot and liquid for any desired length of time.

Since the steel works find that heated mixers give such good satisfaction, why should the foundrymen not follow in the same steps, wherever it is possible to do so? The small non-heated mixer that the writer saw in some German pipe foundries gave good satisfaction and the iron could still be used after two hours' waiting. Heated mixers would give better satisfaction, undoubtedly. Under the action of the flame, which must be of a slightly oxidizing nature, some undesirable refining of the iron would take place, and a small part of the silicon and manganese would be burnt out. But as the iron is poured liquid in the mixer, the oxidation of silicon and manganese would be much less than in the air furnace or the cupola, where from one-fourth to one-third of the silicon is burnt out, mostly during the melting period. In this respect the heated mixer, where no melting is done, should be far more advantageous.

But it has other advantages. It is a well-known fact that the mixer as such is an excellent apparatus for eliminating in a short time a large percentage of the sulphur contained in the iron. In fact, this elimination reaches easily 50 and 70 per cent. The quality of the iron will therefore be considerably improved in the mixer. In the cupola the contrary always happens.

Since the metal can be kept hot to any degree in the mixer, this affords means to correct at once the quality of the metal by melting in it whatever cold pig may be necessary to obtain the right analysis.

Thus the use of the heated mixer for foundry purposes in connection with the blast furnace would seem to present very marked advantages:

1. It would allow the use of direct metal from the blast furnace, thereby saving the remelting cost, which is always high.

2. It would afford an easy and cheap means to eliminate a large percentage of sulphur, thereby, contrary to cupola practice, improving the quality of the iron.

3. It could be used directly to correct the quality of the metal by melting in it a certain amount of cold pig iron, with probably less cost than when the melting is done in the cupola and with certainly less absorption of sulphur during the melting, because the solid pig will melt in the liquid bath and be removed from contact with the flame.

Naturally such a mixer could be used for other than pipe foundry purposes, when proximity to the blast furnace allows its adoption. It would even allow an independent large foundry to use liquid iron from a nearby blast furnace belonging to another company. Both companies would benefit by the practice.

Coming back now again to European pipe foundry practice, improved means are applied in many other respects, all tending toward a general cheapening everywhere. What one notices first in the most modern European pipe foundries is the complete absence of pits. The molding and pouring is done on an upper floor, to which one-half of each pipe flask is fastened; the other half is left free to be slid back. The flasks are never taken from their place; the finished pipe alone is lifted up by the crane, which having less weight to lift, can be lighter than would otherwise be the case. The lower end of the flask hangs freely down to within a certain distance of a lower floor and is accessible from every side. The drying of the flasks is done by producer gas or even blast furnace gas. The producer gas is made in gas producers situated outside the works and carried through underground gas flues underneath the rows of flasks. Here special burners, varying in the different foundries, are used to dry each flask thoroughly and rapidly. In most places gas is also used to heat the core ovens. These arrangements also vary from place to place.

In one foundry in eastern France, where coke is very expensive (fully $5 a ton), special arrangements are made to burn coke screenings from blast furnace coke in the core ovens. The use of this fine coke, otherwise lost, was the cause of a very great saving in the drying of the cores.

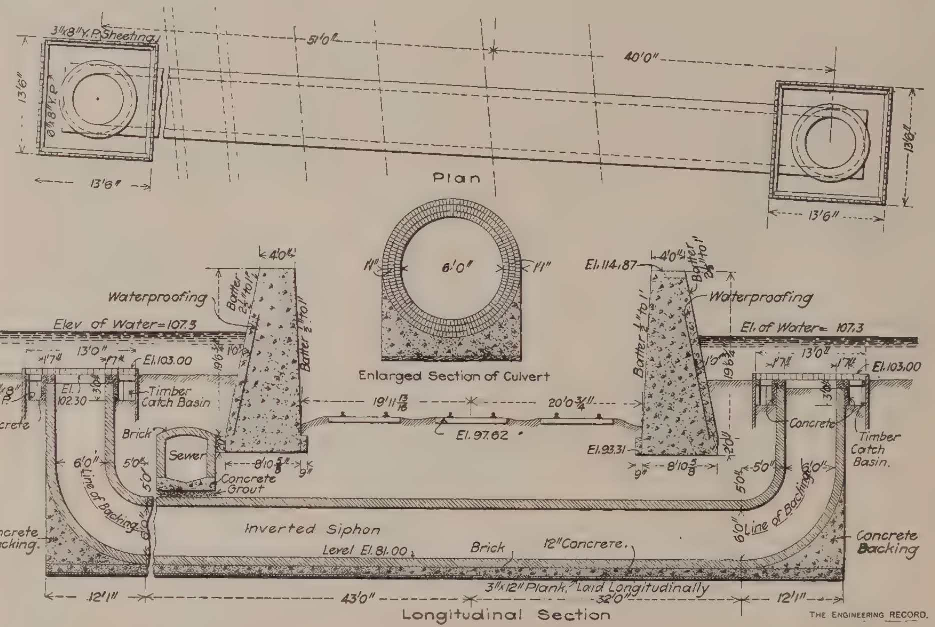
After the pipe is cast the sand falls from the flask and is taken up by conveyors, and after being cleaned and screened, is taken by conveyors to the top floor, where it will be used again in the ramming of the flasks. In some foundries the flasks are put up exclusively in straight parallel rows; in others, especially for pipes of less than 25 in. diameter, revolving pits or drums are used, somewhat similar to what is done at the Chattanooga plant.

In the case of revolver systems the drying of the flask is also obtained with gas. Some very ingenious drying appliances are used in these revolving systems. Tarring appliances also are very modern and of improved style. In fact, the work everywhere is reduced to a minimum.

The Morris Canal Crossing of the Lackawanna R. R.

The tracks of the Delaware, Lackawanna & Western R. R. in the western part of Newark, N. J., are being depressed in a right-of-way wide enough for only three tracks, and the concrete retaining walls on either side of them with slight interuption to the heavy traffic which they carry. The railroad crosses the Morris Canal near the middle of the depression and traffic has to be maintained in the canal while the tracks are being lowered. After the depression is completed the canal boats will have to be carried over the tracks as the level of the bottom of the canal will be several feet above the bottom of the depression. The work of depression west of the canal was described in The Engineering Record, Nov. 19, 1904, and since that date work on the depression east of the canal has been carried on as rapidly as possible. Rather unusual methods have been adopted in carrying traffic in the canal across the railroad during construction and over the tracks after the depression is completed; a temporary flume will carry the water of the canal and the canal boats across the railroad property while the depression work is in progress, and after it is finished the water in the canal will be carried under the tracks in an inverted syphon, while the boats will be taken across on an overhead bridge, with inclined-plane approaches to it from the water surface at both ends.

The railroad tracks formerly crossed the canal on two half-through latticed girder spans and a wide street closely paralleling the tracks on the downstream side crossed the canal on a deck girder bridge. The concrete retaining wall on the downstream side of the tracks was built up to the canal from both sides in trenches in the same manner that was followed on the remainder of the depression work, omitting a 50-ft. section at the canal. The upstream wall was brought up to the canal on one side and will not be built on the other side at present as the railroad company owns a considerable width of property on that side of the tracks at this point.



The Inverted Siphon of the Morris Canal Crossing on the Lackawanna Railroad.

The syphon has a 6-ft. in diameter circular section, built of hard-burned red brick laid in a 1:2 mortar composed of Atlas Portland cement and sand. A temporary dam, with a sheet piling core driven by a small pile driver, was first thrown across the canal above the tracks. The water in the canal was carried around the site of the syphon and under the tracks and the street during construction in a small temporary timber flume; work being done in the spring before navigation opened. A sand-bag dam was built across the canal below the tracks and the excavation for the syphon carried on between the two dams. The excavated material was removed from the trench at the lower end in buckets by a stiff-leg derrick operated by a Lambert hoisting engine and dumped from the buckets into cars on the tracks above. At the upper end it was removed in buckets handled by the hoisting engine on the pile driver and used in a fill in a park adjoining the tracks. The trench was about 10 ft. wide and 30 ft. deep. It was dug through fine sand and loam, which would cave and run when wet, so the whole trench had to be closely sheeted. Considerable water was encountered in the trench, but a Pulsometer steam pump at one end and a steam syphon at the other easily handled the flow.

The original plan was to build the syphon barrel directly on the bottom of the trench, but the material in the bottom of the excavation was found to be uncertain in character, so a plank footing and concrete cradle were added, as shown in the accompanying illustration. The concrete was carried up to the springing lines of the arches and the vertical portions of the syphon were built on heavy concrete footings. The space between the intercepting sewer crossing the syphon and the extrados of the syphon arch was filled with grout. This sewer intercepts all of the sewers on the south side of the railroad, which formerly crossed beneath the tracks, and is connected with an outfall sewer of Newark, which passes near the site of the syphon. A connection between the syphon and this outfall, permitting the syphon to be drained, would have been quite expensive, so sheet piling settling basins, 13 ft. square, will be built around the top of the vertical parts of the syphon at both ends to intercept the silt carried by the water, and if it is necessary to empty the syphon the water in it will be pumped out.

The trench was back-filled when the syphon barrel was finished, the sheeting being left in place. The flume which carries the water and boats until the completion of the depression was then built. It is 13 ft. wide in the clear, carries 5 ft. 9 in. of water and is 160 ft. long. It was built quite heavy and is placed on wooden blocks resting on the ground. The core between the retaining walls on either side of the tracks will be removed and the tracks laid up to the flume and the tow path from both sides before the flume is removed. The water will then be diverted through the syphon, the boats carried across on the overhead crossing, the flume removed and the tracks completed across the old canal bed, after which traffic will be diverted into the depression.

The inclined approaches to the overhead track crossing will be built on piles. The boats will cross at grade on the adjoining street bridge, which will be strengthened to carry the additional load. The canal is at a slight skew with the tracks and the crossing will be carried on two 45½-ft. girders resting on the retaining walls, with a floor of transverse I-beams. The approaches and the crossing will have transverse stationary rollers in their floors and the boats will be drawn up the approaches and over the crossing by an electrically operated hoisting engine. The traffic in the canal is light and by obtaining electric power from feeder wires of a public service corporation, which are strung along the adjoining street, such intermittent power as is required may be had without maintaining a separate power plant at the canal.

The syphon was built under a separate contract by the Sandford & Harris Co., general contractors, Hoboken, N. J., the same firm having done a large amount of work on the general scheme of grade reduction and grade crossing elimination that the Lackawanna has been carrying out in Newark and the vicinity. These improvements are all under the general direction of Mr. L. Bush, chief engineer. Mr. E. I. Cantine is division engineer of the Morris & Essex division, on which the improvements are being made, and Mr. J. H. Philips is assistant engineer in immediate charge of the work.

Turbine Engines are to be used in the only battleships of this year's British naval programme. They are to be of 23,000 h.-p., supplied with steam by Babcock & Wilcox boilers. There will be four shafts, each with one propeller; there will be separate small turbines for low speeds.

Power Plant Supervision and Accounting.

A paper read before the Ohio Society of Mechanical, Electrical and Steam Engineers by F. W. Ballard.

Many advantages are to be derived from the operation of a number of power plants under one management, in spite of the fact that this has been denied by some of our eminent authorities, one of whom makes the statement that "a pound of coal is a pound of coal, and a British thermal unit has an invariable value to the Steel Corporation or to the smallest tank shop." We will, of course, admit the invariable value of the heat unit, but it does not follow that every one can utilize a heat unit to the best advantage in the generation and distribution of power. Indeed, quite the opposite is true, and even in many of those plants where high economy is sought and obtained in power generation, there is a wastefulness in its utilization that would greatly surprise the managers could they but realize it. Industrial consolidation and the operation of many factories under one head is the order of the day, simply because it is the best business policy and presents the most opportunities for economy; and for the same reasons the combined operation of several power plants under one head is good business policy and presents the most opportunities for economy.

These opportunities may be classified broadly under two heads, namely, those resulting from better supervision, and those to be obtained from high grade accounting, together with a close analysis and comparison of results. The supervision and accounting should be under the direction of one man, as they are closely related, and the best supervision can be obtained only where a complete and accurate statement of the expense of all operations is forthcoming at least once per month. It is not meant by this that the general accounting department of the company shall be under the direction of the mechanical engineer, but rather that the system of accounting which pertains to the generation and distribution of power shall be worked out by the head of the engineering department so that the information shown shall be just that which is most valuable for the comparison of results, and which can be best utilized for future improvements.

For the proper comparison of results it is necessary to take into consideration the different conditions under which the several plants operate, and also the different uses to which power and steam are put. The Sherwin-Williams Co., of Cleveland, Ohio, whose system of power plant accounting it is the purpose of the paper to describe, operates a number of factories in different cities of this country, as well as one in Montreal, Canada, and one in London, England. It is this company's experience that expenses depending upon the localities vary to quite a considerable extent, chiefly of course, the prices of coal and labor. It is easy enough to take care of such conditions, but for accurate comparison it is also necessary to take into consideration the different uses of power and the many different purposes for which steam is generated. It is generally the case in factories that the greatest source of loss in the power department is not in power generation but in its distribution. Be the power plant large or small, it is a great mistake to devote all of one's attention to lessening the amount of coal necessary to evaporate a pound of water or to produce a kilowatt of power, when at the same time it might be possible to operate the factory and produce the same results with a consumption of only one-half the amount of power which is being used.

It is not the province of this paper to discuss the hundred different ways in which power may be wasted in transmission, but rather to describe a system whereby places may be located in which a saving can be made. It is hardly necessary to remind engineers that power-driven pumps are more economical to operate than those driven by steam, or that it is more economical to heat buildings with exhaust steam than it is to run engines condensing and use live steam for heating; and yet, in how many places do we find these very things being done in the wrong way at heavy loss? Again, there are a great many less obvious ways in which loss may occur: or from the other way of looking at the question, one might say "that a saving might be made." For instance, the use of steam for drying coils over which a circulation of air is maintained by large blowers, where the same effect might be produced by vacuum dryers, with the consumption of much less steam and power, or the handling of large volumes of air to remove fumes, when the same thing might be accomplished with much less power by simply confining the fumes to small pipes and not allowing them to become mixed with the air. Again, in how many factories is any record kept of the proportion which the shafting load in any department bears to the whole load? And how many factory superintendents know anything about the amount of power consumed by the individual machines?

These are only a few of the very many things in which loss may occur, and where, on the other hand, knowledge is power, or at least, may be the means of saving power. Of course, a great deal of testing must be done to know just what and where results may be obtained. But one of the principal means for locating a prolific source of results is the proper comparison of figures from different plants, and this can only be had with a good system of reports and a high order of accounting.

The object in using such a system by the company might be said to be three-fold: First, the knowledge of what they are doing in each of the plants compared with results obtained by other concerns. Second, it is necessary in determining the actual cost of the various products of the company to know just what to charge each department for heat, light, power, water, gas, etc., and this can only be done when the power plant accounting is of a very high order. Third, it is the policy of the company to rate employees entirely by the results which they obtain. For instance, the "top-notch competition" of the superintendents of the different factories is determined by their relative standing on several different points, chief of which is cost of operation, and as the cost of power generation and distribution is by far the largest item of expense, it becomes a question of very great personal importance with the superintendents to know just what it amounts to and how it can be reduced.

To determine the cost per kilowatt hour at the switchboard, as well as the cost of power consumed in the motor, together with the proper charges to be made to the different departments for the several functions of the power plant in a factory where exhaust steam is used for heating part of the buildings and live steam for the rest, where live steam is used in drying and baking ovens, for heating water, for cooking various products, for running steam pumps in various locations, such as filter pumps, fire pumps, air compressors, circulating water pumps, etc., necessitates a complicated system of reports, which must, on the other hand, be made as simple as possible to facilitate their proper handling by accountants who are not familiar with the technical side of the question.

Before one can determine what his reports shall be like he must first decide on just what he needs to know. In our system we decided first that we must completely separate the costs of power transmission from power generation, because we wished to compare the cost of power at the switchboard in one factory with that in another, as well as with the cost of producing power to other concerns. The next most natural step was the division of the cost of both generation and transmission into service and expense, the generation service being subdivided into boiler room service, engine room service and non-productive service. The last item covers all charges made to power plant for supervision, while the chief engineer's time is divided equally between boiler room and engine. Generation expense is also easily taken care of, and under this division accounts were opened as follows: Maintenance of boilers, maintenance of boiler auxiliaries, maintenance of engines, lubricants, sundries, special items, fuel and removal of ashes.

SCHEME OF MONTHLY POWER ACCOUNTS.

Generation Service.
- Productive:
  - Boiler
  - Engine
    - Total
- Non-Productive.
  - Total, generation service

Generation expense.
- Maintenance of boilers
- Maintenance of boiler auxiliaries
- Maintenance of engines
- Lubricants
- Sundries
- Special items
- Fuel
- Removing ashes

Total generation expense.
- Total, generation service and expense
- Deduct for charges to
  - Insurance
  - Heating
- Net cost, power generation
- Memo. deduction for power other than electrical
- Net cost, electrical power only
- Total Kw. hours at switchboard
- Cost per Kw. hour at switchboard

Transmission service.

Transmission expense.
- Maintenance of pipe lines
- Maintenance of electric circuits
- Special items

Total transmission expense.
- Total transmission service and expense.
- Total cost developing and distributing power
- Total amount power consumed
- Cost power consumed per Kw. hour
- Charged depts. power and light.

Surplus or deficit.

Insurance.
- Watching
- Inspection
- Expense.
- Power
- Total charge to insurance

Per cent. non-productive service.
- Number employees
- Average rate of wages per hour

Depreciation is taken care of under the different headings pertaining to maintenance, and it is not our plan to set aside a separate fund for this purpose, but that whenever a change or repair is necessary it is charged directly into expense as maintenance. Anything, however, which is obviously an addition or improvement and which adds directly to the value of the plant is, of course, charged to plant account, and does not figure in the cost of operation. The only objection to this method of taking care of depreciation is that the cost of power as shown by these reports varies considerably from month to month. Our plan for overcoming this objection will be described when discussing the plan for charging out power to the departments.

The item, total generation service and expense, serves as a mere starting point rather than the true cost of producing power, which would be the case if our power plants were used for no other purpose than to generate electric current for distribution to the different departments. As it is, we make two kinds of deduction from this item before we arrive at what we call net cost of electrical power only. The distinction between these two classes is that those belonging to one are to be charged out to the departments separately, while those belonging to the other will not be charged out to the departments but will be included in the item, total cost of developing and distributing power, and will be charged to the departments by being included in the cost per kilowatt hour of power consumed. The two principal items belonging to the first class are those of heating and insurance.

Under the head of heating we include the charges for steam for whatever purposes it may be used. The charge for steam in the radiators for heating buildings is at the rate of 2 cents per month per square foot of radiating surface for six months in the year. The charge for steam used for other purposes than heating buildings is determined by first taking the condensation for a certain period of time and then estimating the proportion of the total steam generated in the power plant which is being used in that department, and then making a charge of the same proportion of the total boiler room service and expense. If desired, this can be estimated for the year and a constant charge established.

The item which in this report we call insurance and is to be deducted from the total generation service and expense is the cost for operating the fire pump. In some of our factories we are required by our insurance policies to keep an underwriter's fire pump in operation night and day; and in some instances this necessitates keeping up a steam pressure and a man in attendance nights, Sundays and holidays, when otherwise the plant could be entirely shut down. It would obviously be very wrong to include this extra expense in the cost of developing power. It would then have to be borne by those departments alone which use power, while at the same time we would be deceiving ourselves as to the real cost of insurance. The amount of this expense is determined much in the same way we arrive at the charge to be made for the use of steam in the various departments. However, two separate estimates are made, one for the proportion of boiler room expense which the fire pump should stand during running hours, and another to cover the whole expense of operating the boiler room at such times as it could be shut down were it not for the necessity of operating the fire pump. These deductions give us net cost of power generation, to which is added total transmission service and expense in order to find total cost of developing and distributing power, the latter to be distributed among the departments in proportion to the power they use, as determined by recording wattmeters.

The deduction for power other than electrical, which is a still further deduction from net cost of power generation in order to find net cost of electrical power only, includes, as its name implies, all those functions of the power plant other than electrical power which cannot readily be charged directly to the departments. The principal of these are compressed air and the circulation of cooling water for the mills. In neither of these is it practicable to tell how much a department uses, and as the charge to any department for these would be small and quite likely to be very nearly in proportion to the kilowatt hours consumed, it is thought best, for the sake of simplicity, to allow them to be included in the total cost of power, which is not used as a basis of comparison between the plants, but only as the sum to be distributed between the departments of each particular plant.

In making the charges to the departments we do not use the cost for each month as it shows upon the report, because of the great fluctuations due to the variations in the expense of maintenance, as already described, and also to the fact that invoices are not always received regularly. Our plan is to charge the departments for power at that rate per kilowatt hour which is the average for the preceding year. The difference between the actual cost of power for the year to date at any month and the amount charged out to the departments is shown on the report as surplus or deficit, as the case may be, and at the end of the year an adjustment is made in the way of a credit to the departments if the reports show a surplus, or an extra charge if the reports show a deficit. Of course, it is the intention for the reports to show a surplus every year, this being the measure of the improvement of any year over the one preceding. However, if the surplus becomes large and it is evident that the average cost of power is being brought considerably below the price at which it is being charged out to the departments, and it is very probable that it can be maintained so, the proper thing to do is to lower the charge price at once so that the full benefit may be obtained in properly figuring the cost of finished goods. As a matter of fact, we have already lowered our charge price for power 25 per cent. since the first of our fiscal year, which begins the first of September, and it is possible that we may be able to still further lower it before the end of the year.

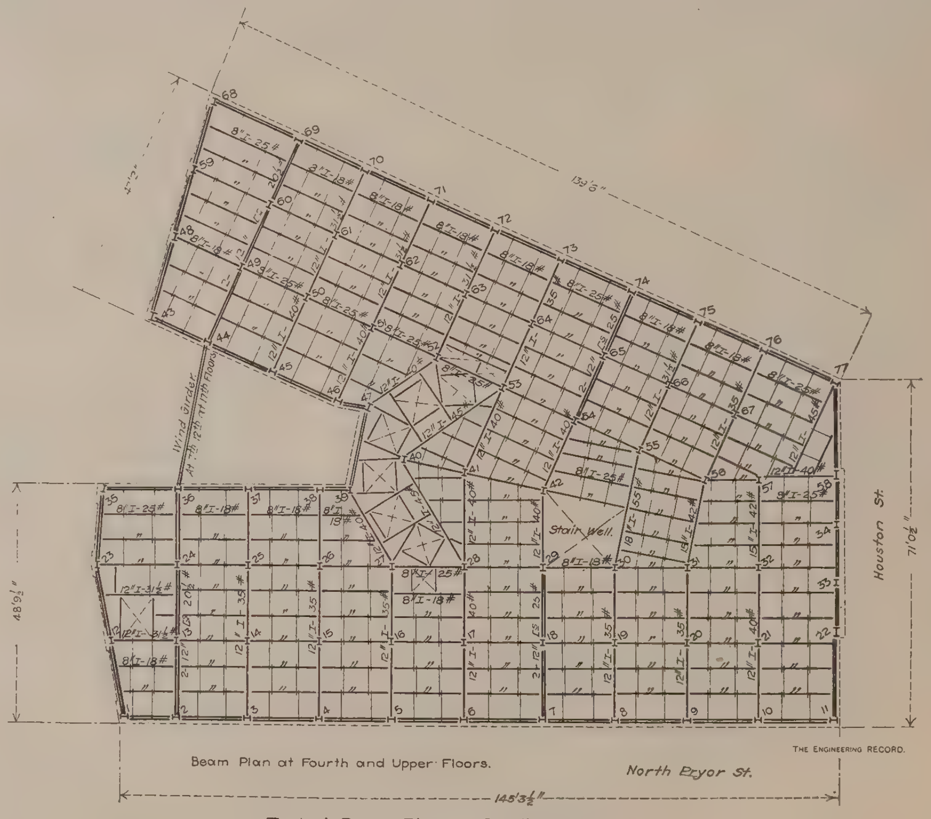
Of course, these reports in themselves can accomplishing nothing, but with us they have been a record of what we have done, and a means for locating possibilities and furnishing an incentive for always trying to accomplish the "best ever."

Excessive Cost in plans for buildings is a fault of which architects are often accused. In Cann v. Rector, 85 S. W. Rep. 994, the Missouri Court of Appeals considers it a ground for returning plans for a church and refusing to pay for them. The decision is substantially as follows: "Where a contract between architects and the vestrymen of a church required the architects to prepare plans, etc., for a proposed building, to the satisfaction of the vestrymen, the fact that the plans drawn were in the hands of the rector for five or six weeks, and that a picture of the perspective of the building was framed by the vestrymen and hung in the vestry room, did not show an acceptance of the plans, so as to preclude their rejection on the ground that they called for too expensive a building, it not appearing that the vestrymen had any knowledge as to what the cost would be." The importance of giving prompt estimates of cost of executing plans is great.

The Candler Building, Atlanta.

The 17-story steel-cage office building for the Candler Investment Co., Atlanta, Ga., occupies an irregular shaped lot about 145 x 125 ft. in extreme dimensions. The exterior walls are faced with white marble and with white terra cotta treated with sand blast to give it the appearance of white marble. The street fronts are paneled and relieved by projecting belt courses partly made by the masonry and partly by the arrangement of the steel framework, and there is a wide overhanging steel framework for the massive cornice. The interior trim in the basement and first and second stories is of San Domingo mahogany and in the upper stories is of quarter sawed white oak.

The sub-basement is devoted to the mechanical and sanitary installations and to power plant, coal bins and general storage. The basement is occupied by a Turkish bath, barber shop, safe deposit vaults and for miscellaneous purposes. The first story is used for bank, stores and similar purposes. The upper stories are for offices.



Typical Beam Plan of Candler Building.

The steel framework is of very simple construction except that the irregularity of the plan complicates the arrangement of the floor beams and girders as indicated in the typical beam plan for all stories above the third. The 77 principal columns are in longitudinal rows parallel to the long sides of the lot and in transverse rows at right angles to the first. Except for the special oblique framing for the elevators near the center of the building, the eight-inch longitudinal floor beams are about 5 ft. apart and 14 ft. 6 in. long and are connected directly to the column webs or to 12-in. transverse beams most of which are about 15 ft. long, dimensions which give a light and stiff floor construction.

The outer walls are carried independently of the floor at every story on girders attached to the column flanges and generally consisting of a 10-in. or a 12-in. channel and a 3 x 3½-in. or a 3 x 4-in. angle. The floors are calculated for a live load of 60 lb. per sq. ft. and are made with flat arches of 8-in., 9-in. and 10-in. semi-porous tiles, levelled up with cinder concrete, over 5,000 cu. yds. of the latter being required for this purpose and for packing the columns.

All columns have H-shape cross sections made with four unequal leg angles and a web plate, reinforced in some cases with two flange cover plates. All are made in two-story sections, from about 23 to 30 ft. long, spliced 18 in. above the floor with a pair of flange cover plates, and a narrow pair of full width web cover plates, clearing the flange angles. In the upper five stories all columns are made with four 5 x 3½-in. angles and a 14-in. web plate. In the lower stories the sections are increased by the use of larger and thicker angles and thicker web plates of the same width and sometimes flange cover plates. The maximum section being four 6 x 6 x 13/16 in. angles, one 18 x 13/16 in. web plate and two 14 x 13/16 in. flange plates. In all other columns the narrow flanges of the angles are riveted to the web and the latter is only 14 in. wide. Where the column section changes filler plates are riveted to the ends of the flanges under the splice plates and give full bearing without horizontal diaphragm plates which are not used on this work.

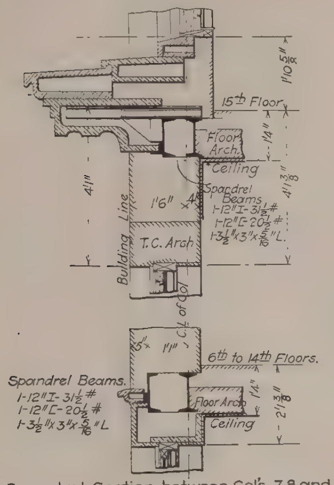
All beam and girder connections are made with horizontal shelf angles engaging the top and bottom flanges and having two field rivets driven through each. For 15-in. and 18-in. beams the lower shelf angle has the horizontal flange supported in the center by the outstanding flange of a short vertical distributing angle riveted to the column. None of the beams or girders has web connections to the columns. All columns have cast iron bases, about three-fourths of which are seated on I-beam grillages bedded in concrete filling on rock. The remainder of the bases are seated directly on the concrete without grillages in places where excavations were made in the solid rock to receive them. Where the surface of the rock was unsound it had to be excavated in some place 7 ft. below the bases and here grillages were used.

Wind bracing is provided by struts across the light court and in all but the rear and court sides of the building, by solid-web kneebraces with inclined flange angles, shop-riveted between the webs of the wall channels and field-riveted to the columns. The thickness of the plates and size of the angles in these braces increase from the upper to the lower stories. The court struts from the 7th, 12th and 17th floors are plate girder portals with concave bottom flanges made in two pieces, shop-spliced in the middle with a cover plate and cover angles.

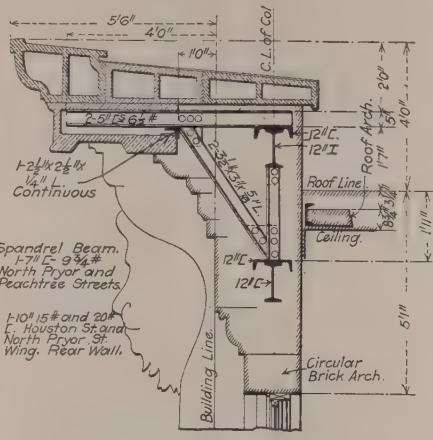
A triple-web plate girder carries two intermediate upper story columns over a wide entrance span in the front wall of the building. The girder is seated on the caps of the second-story columns, and its end vertical cover plates are continued below the column tops and field-riveted to the column flanges. The third-story columns are seated on the top flange of the girder so that the latter forms a section between the columns at both ends, and is stiffened accordingly by filler web plates and several pairs of vertical angles.

The cornice on the street fronts projects 7 ft. beyond the centers of the wall columns and rises 4 ft. above the surface of the roof to form a parapet. It is made of hollow terra cotta blocks supported on steel cantilever frames about 2 ft. apart, as shown in the cross section detail. Each cantilever consists of a pair of channels back to back making an I-shape cross section, and kneebraced at the center by a pair of inclined angles. The cantilevers are anchored to girders having T-shape cross sections to resist vertical and lateral deflection, and similar girders, also made with a 12-in. I-beam and a 12-in. channel, and connected to the wall columns 3½ ft. below them to receive the thrust from the feet of the kneebraces.

The projecting belt course at the 15th story

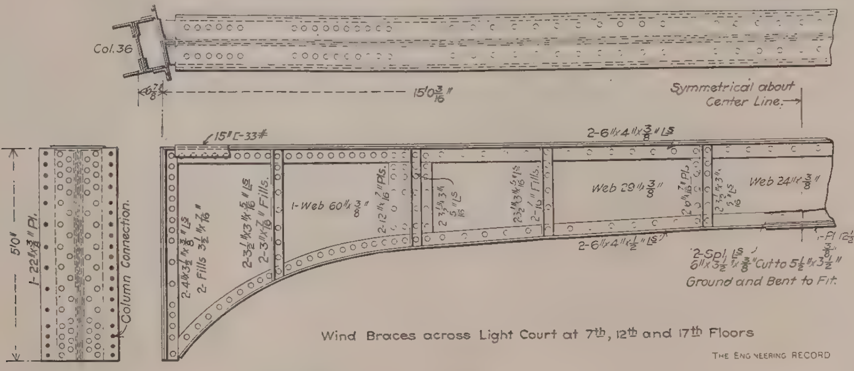


Spandrel Section between Col's. 7, 8 and 73, 74 North Pryor St. and Peachtree St. Sides. Flush Bays.



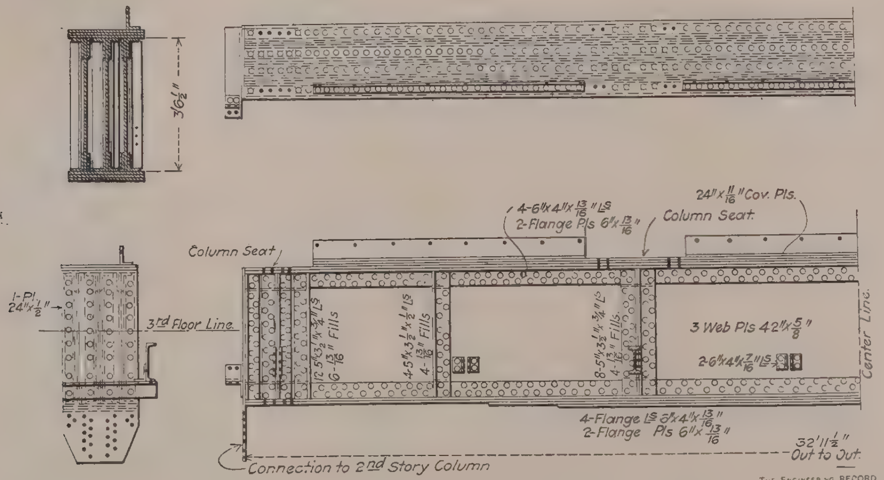
Spandrel Section. All Street Sides and Rear Wall North Pryor Street Wing.

THE ENGINEERING RECORD



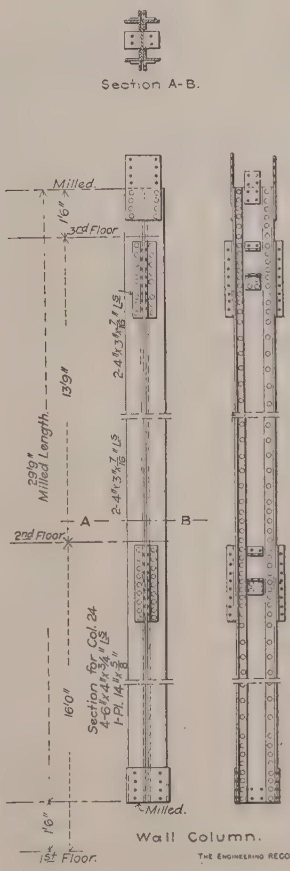
Wind Braces across Light Court at 7th, 12th and 17th Floors

THE ENGINEERING RECORD



Third Floor Girder, carrying Two Intermediate Columns.

THE ENGINEERING RECORD



Wall Column.

THE ENGINEERING RECORD.

Characteristic Details of Superstructure of Candler Building.

extends 4 ft. beyond the column centers and is also made with hollow terra cotta blocks and red brick backing. The blocks in the lower course of terra cotta engage horizontal steel cantilevers about 2 ft. apart which reach through nearly their full width and are anchored by field-riveting across the tops of the wall channels which support the brickwork and the adjacent outer floor beams. They are also strengthened by solid-web kneebraces which have vertical flanges bearing on the webs of the wall channels just above continuous angle shelves which receive the lower edges of the terracotta.

The building which previously occupied the site was torn down in the summer of 1903 and an excavation was made which reached rock at a minimum depth of about 16 ft. About 7,000 cu. yd. of rock was removed and all footings carried down to sound strata. The designs for the new building were commenced in February, 1904. The pound contract for the steelwork was awarded in March, 1904, and its erection was commenced September 15, 1904, and completed December 24, being all accomplished with two traveling stiff-leg derricks of 10 tons capacity operated by two Lidgerwood hoisting engines permanently located in the basement. One derrick was kept on each side of the building and each in turn hoisted the other to the next story as the successive tiers of beams were assembled. The brick walls were commenced in October and it is expected that the building will be ready for tenants in September, and will be completed in December, 1905.

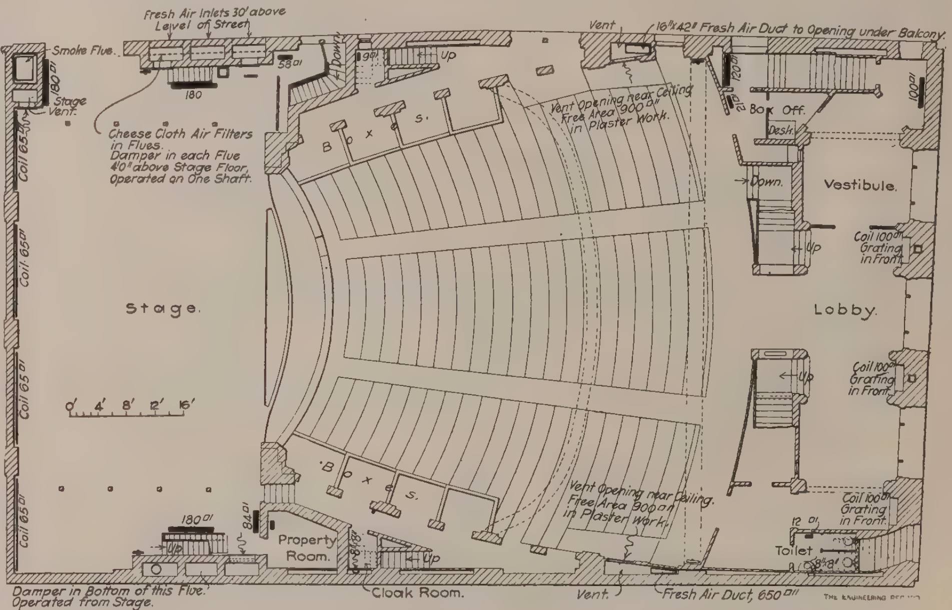
The equipment of the building includes three 212-h.-p. Sterling boilers; two 200-kw. Westinghouse generators direct-connected to a C. & G. Cooper Co.'s cross-compound Corliss engine with 18 x 30-in. and 30 x 30-in. cylinders; one 125-kw. Westinghouse generator direct-connected to a similar engine with 14 x 30-in. and 24 x 30-in. cylinders; six passenger and one freight elevators of the inverted plunger Otis type, operated by an accumulator in which 750-lb. pressure is maintained by two Laidlaw-Dunn-Gordon three-cylinder compound, outside packed, single acting, crank and flywheel high duty pumps; a Kenny compressed air sweeping and scrubbing plant, and two 15-ton De La Vergne ice machines used for cooling the air in some rooms and for cooling drinking water in two fountains.

Mr. Geo. E. Murphy, of Atlanta, is the architect of the building. A great part of the work is being done by the day, although some of the departments have been contracted. The 2,500 tons of constructural steel was furnished by the American Bridge Co. The Haydenville Co., of Haydenville, O., furnished the semi-porous terra cotta partitions, of which there were 6,000 tons. The Perth Amboy Terra Cotta Co., of Perth Amboy, N. J., furnished the 1,400 tons of terra cotta for the exterior of the building. The bricks were furnished by the South River Brick Co., of Atlanta—2,500,000. The Farrell Heating & Plumbing Co., of Atlanta, was the contractor for the steam heating, the Paul system being used. Mr. W. H. Spellman, of New York, was the contractor for the plumbing, the Durham system and Mott's fixtures being used throughout. The Watson-Flagg Co., of New York, is the contractor for the electrical wiring. Mr. J. R. George, of Atlanta, is contractor for the plastering. Plaster was furnished by the U. S. Gypsum Co., of Chicago. The interior woodwork is contracted for by the Woodward Lumber Co., of Atlanta. The pumps for general service throughout the building are made by the Herron Pump & Foundry Co., of Chattanooga, Tenn. There has been used in setting the exterior work on the building 6,000 bbl. of Howard hydraulic cement. All concrete work has been done with Southern States Portland cement, of which there has been used about 7,000 bbl.

Heating and Ventilating System of the Majestic Theatre, Boston, Mass.

In the design of the heating and ventilating plant in the new Majestic Theatre in Boston, Mass., particular attention was given to securing and distributing evenly the fresh air supply, while among other features may be mentioned the arrangement by which the vents may be closed and the air in the theatre recirculated locally when not in use, thereby effecting considerable economy. Another feature deserving notice is the use of exhaust fans in the gathering chamber under the roof so that positive ventilation is secured.

The general scheme of air distribution used employs the usual plenum chamber method from which branch delivery ducts lead to all portions of the auditorium. The chamber is formed by the open space or basement area beneath the sloping dress circle floor, into which the large blower delivers fresh air directly. The openings into the lower portion of the auditorium are made through the floor while delivery to the balconies is similarly made through ducts leading to a supplementary plenum chamber beneath its floor. Vent connections are carried from the dressing and various other auxiliary rooms in the basement and from all portions of the auditorium to the gathering chamber beneath the roof, from which the air is exhausted by power. The air is removed from the toilet rooms to the gathering chamber by a separate set of ducts.


Fresh Air Inlets 30' above Level of Street
Smoke Flue.
180 □"
Stage Vent.
180
58 □"
Down
9 □"
Up
Vent
16"x42" Fresh Air Duct to Opening under Balcony.
120 □"
21 □"
Box Off.
Desk
100 □"
Cheese Cloth Air Filters in Flues.
Damper in each Flue 4'0" above Stage Floor, Operated on One Shaft.
Boxes.
Vent Opening near Ceiling Free Area 900 □" in Plaster Work.
Down.
Vestibule.
Up
Coil 100 □" Grating in Front.
Coil 65 □"
Coil 65 □"
Stage.
Lobby.
Coil 65 □"
0' 4' 8' 12' 16'
Coil 100 □" Grating in Front.
Up
Coil 65 □"
Boxes.
Vent Opening near Ceiling. Free Area 900 □" in Plaster Work.
Coil 100 □" Grating in Front.
180 □"
84 □"
Property Room.
Up
12 □"
Toilet
Damper in Bottom of this Flue. Operated from Stage.
Cloak Room.
Vent.
Fresh Air Duct, 650 □"
The Engineering Record

Main Floor Plan, Showing Arrangement of Fresh Air and Vent Flues.

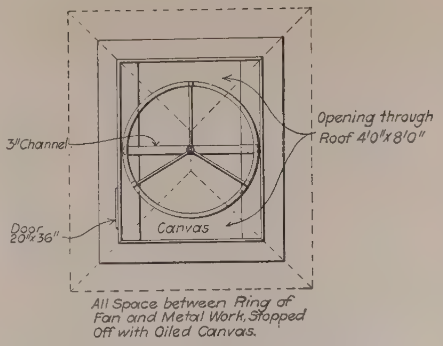
The heating, power and lighting systems of the theatre are operated by an isolated plant located in the rear of the basement at the street side, as shown in the basement plan, the boiler room section, 16 x 20 ft., being within the building proper while the coal storage, boiler auxiliary apparatus and the generating plant occupy a space 12 x 76 ft. beneath the sidewalk. The apparatus installed consists of two Babcock & Wilcox water tube boilers of the cross drum type, as adapted for confined spaces, each of which boilers is of 102 h.-p. rated capacity. The generating units consist of two direct-connected sets, one of 50 kw. and the other of 75 kw. capacity, both of which were supplied complete by the Ridgeway Dynamo & Engine Co. Both engines are simple, the 75 kw. unit operating with 15 x 14-in. cylinder at 250 r.p.m. and the 50 kw. unit with 13 x 12-in. cylinder at 275 r.p.m.

In the engine room the piping system consists of an 8-in. steam line leading to the two generating units and also to the pumps; an 8-in. exhaust line leading to the heating mains, and through a back pressure valve, to an exhaust riser near the smoke flue; a 6-in. heating main for supplying the primary heating coils, tempering coils and radiators throughout the building; and a 1½-in. brass feed line from the boiler feed pumps. Connection is made to the heating main from the high pressure main through a pressure reducing valve, so that live steam can be added to the exhaust for heating if necessary. The drips from the heating coils and radiators are collected and automatically returned to the boilers by an automatic pump governor. A 300 h.p. Berryman feed water heater in the feed line is supplied by the exhaust from the boiler feed pumps, which consist of two 6 x 4 x 6-in. Worthington duplex brass-fitted pumps, operating in connection with a Kieley pump governor.

The fresh air for the ventilating system is taken through inlets in the outside wall of the building about 30 ft. above the street, or on the balcony floor level. From these it is led downward through three 2 x 6 ft. ducts built in the wall to a large horizontal concrete duct beneath the engine room floor, which leads across to the blower, as shown in the basement plan. This duct and the connection to the blower contain the heating coils for cold weather use. The fan is a 7-ft. Sturtevant three-quarter-housed blower, with a direct-connected motor of 10-h.-p. capacity, and is located in one corner of the basement area, or plenum chamber, into which it delivers directly. The air is cleansed for the system by a series of filters of the usual construction of cheese cloth upon light pine frames; these are hung at the bottom of the vertical fresh air flues where entrance is had to the horizontal duct, so that they are easily accessible for cleaning.

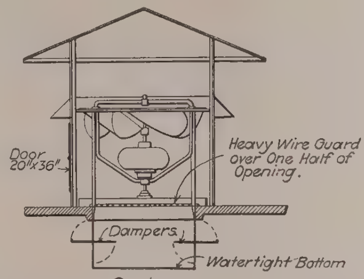
The arrangement of these ducts and connections and also the heating apparatus is shown in the basement floor plan of the theatre. The air passes first through a large primary or tempering heater, which is located in the horizontal duct beneath the engine room floor and thence to the blower through the main heater, which may, however, be by-passed by the mixing dampers, as shown in the detail sketches. The primary heater consists of eight sections of coils, six of which have 180 sq. ft. of heating surface and the other two 160 and 140 sq. ft., respectively. The main heater is composed of 1,872 linear ft. of 1-in. pipe.

Both the main and the primary heater have the electro-thermostatic control of the Johnson Service Co., the thermostat governing the primary coils being located within the duct near the coils; the main heater has the Johnson control on both the coils and the mixing dampers, for accurately controlling the temperature within the theatre. The mixing dampers permit the entire flow through the main heater to be instantly cut off and by-passed, or partially by-passed to any degree desired. The primary heater is designed to heat the fresh air from zero to 60 deg. at the maximum blast of the fan. The Johnson thermostatic control is also applied to all of the direct radiators in the building which are distributed as shown in the drawings.



All Space between Ring of Fan and Metal Work Stopped Off with Oiled Canvas.

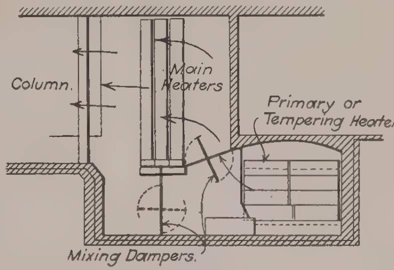
Plan of Vent Opening through Roof.



Section.

THE ENGINEERING RECORD.

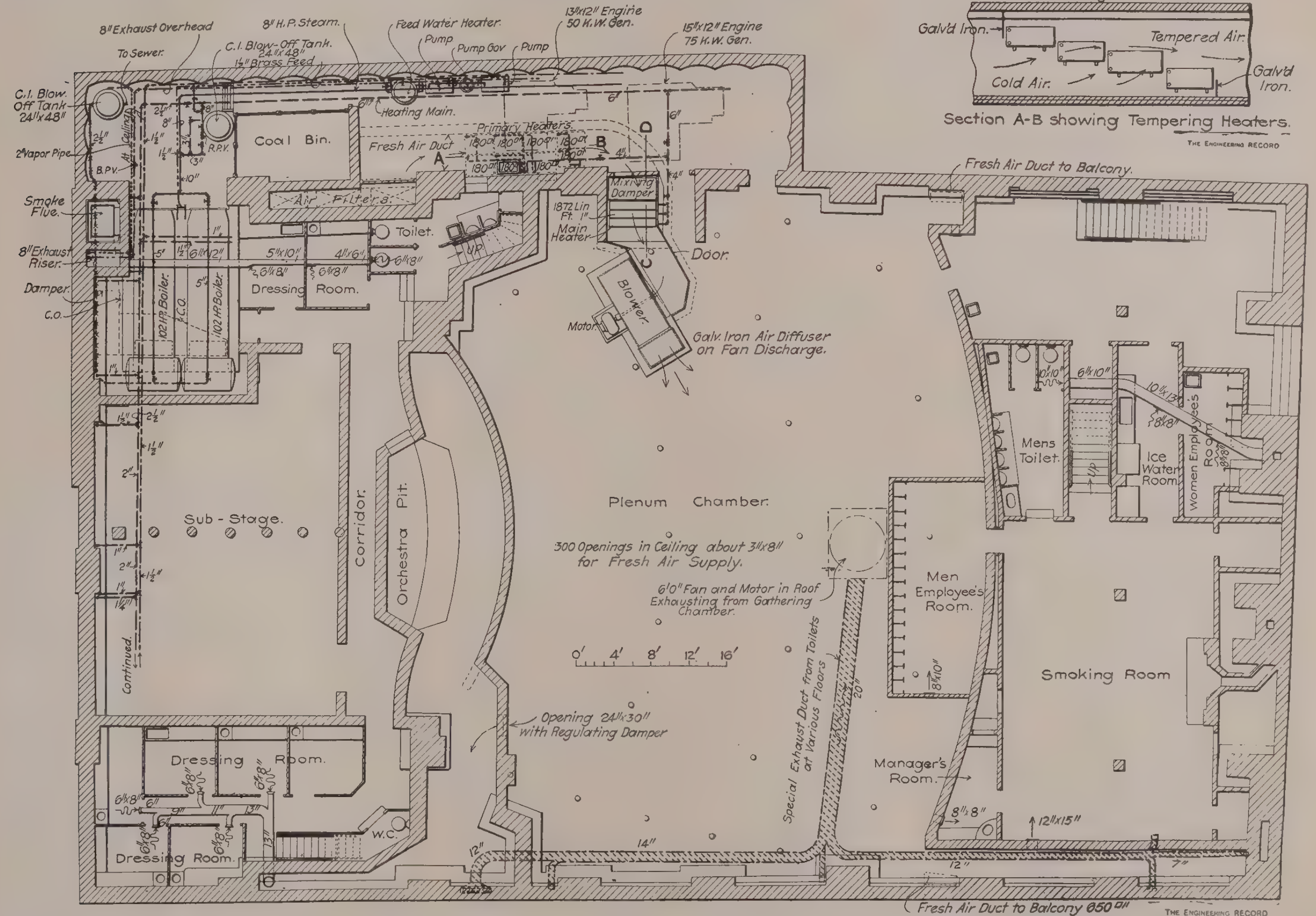
The Motor-Driven Exhauster in the Roof



Section C-D. showing Heaters and Mixing Dampers.

Section A-B showing Tempering Heaters.

THE ENGINEERING RECORD



THE ENGINEERING RECORD

Basement Plan of the New Majestic Theatre at Boston, Mass., Showing Details of Mechanical Plant, Blower Apparatus, Etc.

The principal delivery of fresh air to the auditorium proper is made through holes in the floor beneath the chairs. The chair legs away from the aisles are of a special design to cover these openings, which are distributed to the proportion of about one to every three chairs. There are about 300 of these openings in the main floor, each of which has a cross section of about 27 sq. in. A similar distribution is made from the balcony floor, there being an auxiliary plenum chamber in the space underneath it, which is supplied from the main plenum chamber by two large galvanized iron ducts, each having a cross sectional area of 650 sq. in. From this chamber air is admitted to the balcony through 2½-in. holes in the risers, of which openings there are about 1,200, which gives an even distribution throughout the balcony.

The foul air is vented from the auditorium through openings in the ceiling and a gathering chamber above, while for the spaces beneath the balcony and gallery there are vent openings in the side walls and ceilings as shown in the drawings. The side wall vents from beneath the gallery and balcony, as well as also the stage vents, lead directly upward to open air and exhaust by natural draft, but exhaust from the gathering chamber above the auditorium is forced by a 60-in. fan or exhauster blower, of special construction, located in the roof. This exhauster is illustrated in an accompanying drawing; it is a vertical Sturtevant motor-driven fan, arranged over the vent opening with provisions for easy access for care and attendance of the motor. Ventilation of the toilet rooms is secured by means of an independent set of ducts leading from them to the base of the exhauster in the gathering chamber, as shown.

A novel feature of the ventilating system is the arrangement for circulating the air in the theatre when not in use. The fresh air inlet ducts leading to the heating coils and blower are provided with openings into the stage area, which are controlled by dampers in connection with those admitting air to the gathering chamber above the auditorium; by closing the latter and opening the connection from the cold air duct to the stage (which closes the connection with outside air) the air within the theatre travels in a closed circuit through the heating coils, plenum chamber, etc., with very economical results in the initial heating of the theatre in cold weather. The dampers in the ceiling of the auditorium, as well as also the main damper in the roof opening, are controlled from the stage.

The entire boiler and the heating plant was laid out by James M. Wood and John Galen Howard, associated architects, and was installed by Lynch & Woodward, heating and ventilating contractors, of Boston. Mr. Wood withdrew from the work in the early stages of the designing of the building and it was carried out under the direction of the firm of J. G. Howard and D. E. Waid, architects, of 156 Fifth Ave., New York.

Purchased Electric Power in Factories.

The use of electric motors for driving factories has been discussed from many points of view, but one of the most interesting is that of the central station manager. The daytime load afforded by shop tools is good business for a central station if it can be obtained at reasonable prices, but it is interesting to observe that these prices are not so low as those claimed for the electrical drive by some of its friends. For example, at the recent convention of the National Electric Light Association, Mr. E. W. Lloyd stated that the question of power for a factory could not always be determined on the kilowatt-hour charge for current from different sources. To anyone who has had experience with installations of motors driving machinery where one large motor was used, it is known that no economy can be obtained over engine drive with profitable rates for central station service. It may be possible with the use of a few motors in a large plant running 15 to 24 hours a day with a low rate per kilowatt-hour, that central station power can compete with engine drive; but the average plant does not run more than ten hours a day, and, therefore, the rates of a central station company doing a profitable business cannot compete successfully with these conditions. It is, therefore, necessary to consider other sides of the factory power subject than merely the question of price per kilowatt-hour.

The most important fact that has been developed to-day in connection with this subject is that the proper motor installation has everything to do with the economical furnishing of electric current from central station service. Mr. Lloyd thinks central station managers will agree that in a great many cases where factory power was lost to them the fault lay in the fact that the motor installation eliminated none of the wastes in the plant that were in evidence when it was driven from an engine. While it is no doubt difficult to convince managers that the installation of a great many motors is the only economical method of driving, it is becoming less difficult each day to demonstrate the efficiency of individual or good group-drive installations of motors. The elimination of all friction loads in a factory makes a wonderful difference in the kilowatt-hour consumption. It is a well-known fact that the efficiency, flexibility and output of a tool is materially increased with the use of individual motors. While it is true that the installation of individual motors increases the connected horse-power load in a given factory over and above what it would be should group-drive installation be made, it is also true that the current consumption is considerably less on the individual motor installation.

The agent sent out by the central station company to obtain factory business must make a special study of factory conditions. Starting in the engine-room he must understand the coal consumption of different types of boilers and the steam consumption of the different types of engines. While it is very likely he can obtain from most factory managers the coal consumption in the plant, it is very necessary that the agent know whether this coil consumption is correct or whether it is abnormal considering the engine and boiler installation. If the coal consumption per horse-power be high it is a point of favor of central station service. It must be taken into consideration that in a great many plants they do not always keep a correct record of the plant costs, and, in view of this fact, it is necessary to know what items go to make up these costs. The mere costs of fuel and labor are not by any means all of these costs. The items enumerated below are those that can generally be considered as making up the total cost of operating an isolated plant: Salary of engineers, firemen and electrician; fuel, removal of ashes, water, oil, repairs to boilers, engines and dynamos, lamps, carbons, tool account, miscellaneous expense and supplies, general expense, depreciation (10 per cent. to 15 per cent.), interest on investment, insurance, rental value of space, damage resulting from heat and vibration, risk to employees and the public through accidents and boiler explosions, taxes. In addition to the above plant costs, it is often necessary to add the following: Maintenance of rope or belt transmission lines, unnecessary investment in shafting and hangers, salary of millwrights.

If the factory manager has not kept a correct account of the above items it is necessary that the agent be familiar with plant costs and also with the operation of the machinery in the plant, and be able to estimate these costs. He must, furthermore, understand the operation of different kinds of machinery and know approximately what power each machine takes. This may seem a difficult proposition for the station manager who has to hire solicitors, but an intelligent agent can accumulate a surprising amount of information in this direction in a year.

It is extremely difficult to determine at times what the average power consumption on a given plant would be if the friction loads were eliminated. Taking indicator cards from an engine for one day, or even for one week, does not determine the average load nor the friction load throughout the year, as the factory may have dull periods when the average load will be less and the proportionate friction load more; not only that, but the large friction load on the average plant cannot easily be determined, owing to the impossibility of cutting off all the running belts and countershafting. In arriving at the power consumed by a factory having engine drive it should be remembered that should the proper motor installation be made a large percentage of the friction loss would be eliminated.

In equipping a factory with motors it is necessary to use a fairly efficient motor. If poorly designed motors are used there can be a great loss of current in the motors themselves, and while it is true that manufacturers are making the average motor more efficient to-day than it ever was made, it is well to consider the matter of efficiency and see that the motors to be used are of a good make. It is not always the question of electrical efficiency, however, that should govern the make of motor to be used. If the motor is poor mechanically, it can cause more trouble in the course of a year than would the lack of electrical efficiency. The average factory superintendent does not understand electricity, and when motors are first installed in his factory and he has trouble with them from different causes, he is very apt to become prejudiced against central station service on this account. The troubles with brushes, commutators, brush-holders and bearings are most frequent where direct-current motors are used. With alternating-current induction motors, troubles are of infrequent occurrence and do not require the consideration and attention the direct-current motor does, Mr. Lloyd states.

The speed of the motors for driving machinery should be considered and the method of driving machines should receive the careful consideration of the agent handling the job. While it is not absolutely necessary that the central station install these motors, Mr. Lloyd believes it should have some voice in the matter. Where the company has a construction force for carrying on commercial electrical construction this department can be used to great advantage in this work. A part of this construction force can be educated in the installing of motors, and efficient work on their part will do a great deal toward keeping the customers satisfied.

When endeavoring to convince a factory owner that he should accept central station service, his attention should be called to the fact that there are other reasons besides saving in cost of current that should convince him that this service is to his advantage—such as the elimination of smoking chimneys; inability to get coal should there be strikes; breakdown of the transmission shafting, stopping the entire plant; breakdowns of engines or boilers; the liability of accidents in the plant from explosions or other accidents; cleanliness; the absence of belts, vibration and heat; and, as before stated, the increased efficiency, flexibility and economical operating of the machines throughout the factory operated by motors. The output of a tool can be materially increased by such installations, and, therefore, the investment in tools decreased for a given output. Furthermore, there is the reliability of service from the central station at any time during the twenty-four hours. Should he have a particular contract where it is necessary to run a few machines in order to turn out goods, he can run this part of his factory very economically, it being only necessary to use such motors as are direct-connected the machines that are required to do such work. There is also the fact that should his business increase it is only necessary to expend a small amount of money in order to increase the capacity of his power plant, instead of buying a new generating unit or of running a very large engine on an uneconomical load for a number of years.

Electrically Driven Centrifugal Pumps for Elevator Service.

The store of the John Taylor Dry Goods Co. in Kansas City, Mo., occupies a city block and has an unusually complete power plant, designed by Mr. W. K. Palmer, of that city. It contains three direct-connected electric generator units, two of 75 kw. and one of 160 kw., each consisting of a tandem-compound, high-speed engine driving a double-voltage, three-wire, continuous-current generator mounted upon the extended shaft and sub-base of the engine. These units supply power for operating feed pumps, elevator pumps, a ventilating fan, an ice machine, circulating pumps, and other apparatus. Every piece of moving apparatus is actuated by an electric motor, there being no steam-driven machinery in the installation.

Perhaps the most notable feature is the battery of three high-pressure turbine pumps, two of 300 gal. and one of 500 gal. capacity per minute. Each smaller pump is driven by a 45-hp., 220-volt motor, and the large one by a 220-volt motor of 70 hp. These machines were designed to maintain a pressure of 140 lb. in the hydraulic system. Their motors are under the control of standard Cutler-Hammer automatic controlling apparatus which is mounted on panels and assembled uniformly with the panels of the main switchboard. The three pumps supply the water required for the complete hydraulic system, upon which all the hydraulic elevators of the store are connected. These elevator machines are separated widely over the premises, in some cases nearly a city block apart.

The arrangement of piping for this system has proved satisfactory in service. There is one pressure main from the discharge openings of the pumps, which runs throughout the whole building past each of the elevator machines. This main is connected into a compression tank in each end of the building, these two tanks being set at the same level and carrying their water lines at the same height. The connection for each elevator machine is then taken from this main at a convenient point. There is a discharge or return main paralleling the pressure main into which each elevator machine discharges, and this return main is connected to each of two open surge tanks located near the compression tanks, then continuing on and connecting to the suctions of the pumps. With a suitable arrangement for snifting entrained air out of this suction line, the operation of the system is perfect.

The capacities of the three units were chosen to fit the service requirements with a single unit or combination of units at all times throughout the variations of load during a day's run, while at the same time providing a reserve capacity for accidents, or contingencies. During the hours of light load, one of the 300-gal. units operated at normal capacity will carry the service. During the hours of heavier service the 500-gal. pump will take care of the load, and during the hours of maximum load some combination of two of the three units which will satisfy the demand. These sizes were adopted only after a careful study by the engineers, in advance of the installation of the elevator equipment. Experience has demonstrated that the proportions determined upon were right and the service has been all that could be desired.

These pumps were selected from among a large number of types of pumping equipment offered for this plant, on considerations of economy, noiseless operation and great compactness, all of which were of the utmost importance in this particular instance. A thorough discussion of the problems involved showed that no other type of pump could be installed in the available space that would provide the requisite capacity with anything approaching the degree of economy guaranteed by the makers of these pumps and properly to be expected from them. Likewise, no other pump proposed could be installed, in the sizes demanded, in the floor space occupied by this installation, there being available a total floor space of only 160 ft. The importance of compactness will be more fully realized when it is stated that this installation is two floors below the ground in a sub-basement in which there are many building columns and other obstructions, and where a very limited space was allowed to the engineers for the mechanical equipment. Furthermore, noiseless operation was essential in view of the location in a department store. The engineers were not satisfied to adopt these pumps until a careful test of them and a most rigid guarantee of their satisfactory operation had been obtained. In the Equitable Building at Atlanta, Ga., a similar pump was being tried in place of the steam pump installation operating the hydraulic elevators. The engineers went to Atlanta and made an examination and test of the performance of this pump and as a result decided in favor of the adoption of this type, but added the further feature of the Cutler-Hammer control apparatus, which would automatically start and stop the pumps to meet service conditions.

The nature of the turbine pump is such that a control device is not required except from considerations of economy. The pumps will automatically cease to discharge when the maximum pressure of the system is reached and the current consumption of their motors will fall to that required to merely rotate the mass of water in the impeller chambers. When the pressure is reduced discharge begins and the current increases proportionately to the amount of pumping done. Consequently, the pumps will operate entirely automatically without any special controlling apparatus, which is greatly in their favor, but the addition of the Cutler-Hammer controlling mechanism is considered a step toward greater economy.

Attention is called to the details of the installation of these pumps The discharge from each pump is conducted through a special enlarging cast-iron return bend and inverted nested check valve into a conduit under the floor where it is connected to the pressure main of the hydraulic elevator system. The suction main is also laid in a carefully planned conduit and the section of each pump is provided with a separate gate valve. The foundations are of concrete so formed as to provide ample space for the piping connections and suitable connections to the mains laid in the concrete conduits under the floors. These conduits are accessible through cover-lid sections carrying on them the tile flooring uniform with the rest of the engine room floor, and readily removable, uncovering all parts of the piping for inspection.

Book Notes.

An excellent map of the underground and elevated railways in New York, with notes on the running time of the subway trains, can be obtained from George H. Daniels, general passenger agent of the New York Central lines, for a two-cent stamp. The folder also contains a clear street map of Manhattan south of 140th St., giving the location of ferries, hotels, clubs and theaters.

A number of years ago Mr. Bradford Lee Gilbert published a portfolio of illustrations of railroad structures and kindred structures designed by him in the course of his long architectural practice. Probably nobody has had such a wide experience in railway design, and the two hundred illustrations in this book accordingly represent the work of a specialist. Many of them are accompanied by floor plans and descriptive notes. (New York, Railroad Gazette; cloth, 4to, $3.25.)

Recent numbers of the Red Book series of the British Fire Prevention Committtee are as follows: No. 92, an account of a fire test with a 2½-in partition of Mantada slabs. No. 93, an account of a fire test with a 2⅛-in. partition of the same slabs. No. 94, fire tests with the automatic fire alarm system of the Autopyrophone Co., of Copenhagen. These reports state merely the bare facts of the tests, with tables, diagrams and illustrations, and give no opinions or criticisms on the results. Investigations of unpatented construction are conducted at the committee's expense and others are charged to the manufacturers of the tested materials at cost. All official tests are attended by representatives of the committee and are wholly under its direction. (London, Chas. Adami, 1 Waterloo Place, 2s. 6d. each.)

A monograph on "Earth Dams," representing much careful study and considerable experience, written by the late Burr Bassell, has been published by the Engineering News Publishing Co., New York. The author gives a general discussion of the priniples to be followed in designing such a structure and of the materials to be used in its construction, and describes a number of important structures of this type. Among them are the Tabeaud dam, 123 ft. high; the Yarrow dam, 100 ft. high, with a puddle cut-off going down 97 ft.; the Pilarcitos and San Andreas dams, each 95 ft. high; the Druid Lake dam, 118 ft. high, and the San Leandro dam, 125 ft. high. While in some statements the author was inaccurate, as a rule, he gave only the best of advice, and the book doubtless represents the best practice in high earth dams better than any other monograph.

The correct estimation of high temperatures has become so important in many industrial processes and in certain engineering investigations that the scholarly monograph on "Optical Pyrometry" by Messrs. Waidner and Burgess deserves special mention. It was originally published as a part of the second bulletin of the Bureau of Standards at Washington, but has since been issued as a separate pamphlet. It gives a general description of optical pyrometry and the laws of radiation which make clear the principles on which the instruments depend. The methods of optical pyrometry are explained, and then the construction and use of the Le Chatelier, Féry, Mesuré & Nouel, Wanner, Kolborn-Kurlbaum and Morse instruments are taken up in much detail. The monograph closes with a discussion of a number of special problems in optical pyrometry.

The work by Prof. Gardner C. Anthony entitled "Elements of Mechanical Drawing" has been entirely revised and appears now in a compact form useful for self-instruction as well as class work. The opening portion on the use of instruments is clear and concise. The geometrical problems are well explained and have been so selected as to cover the requirements of most drafting rooms. The chapter on conic sections is particularly good. The discussion of orthographic, isometric and oblique projection covers these subjects sufficiently to give the young draftsman a working knowledge of the methods of making the projections which are needed in designing. The development and intersection of surfaces and methods of laying out spirals, helices, screw-threads and bolt-heads are taken up, and there are a large number of problems for the student to work out. The book is the result of much experience in teaching mechanical drawing and in its revised form deserves to maintain its popularity. (Boston, D. C. Heath & Co.; cloth, 12mo, $1.50.)

Some important changes have been made in the U. S. trademark laws, which it is important for those who value their trademarks to understand. In some respects the protection afforded by a trademark is more valuable than that of a patent, for in the case of any product which depends for its value mainly on conscientious selection of materials and good workmanship the trademark of the maker is practically the only criterion of value. Another advantage of trademark protection is the quickness with which any infringement of it can be settled in the courts, in comparison with the tedious and expensive litigation over patents. A commentary on the new act by Mr. A. P. Greeley, lately assistant commissioner of patents, explains the provisions of the new act and its effect on previous custom respecting registration of trademarks. The discussion is published under the title "Registration of Trademarks under the New Trademark Act," and is published by John Byrne & Co., Washington. The rapidly increasing importance of the subject makes the pamphlet particularly timely, while the author's official and private experience in such matters lends authority to his clear treatment of the subject.

The Department of Commerce and Labor has recently issued two bulletins of value to those who are interested in the development of the Philippines. The first, on the climate of the islands, is by Rev. José Algué, director of the Philippine Weather Bureau. While the temperature at the sea level is practically the same throughout the archipelago, the topography of the different islands has a marked effect on the local distribution and amount of rainfall, and consequently on agriculture. The prevalence of typhoons is another feature of the climate which has an important effect on island industries and commerce. The author of the report has been in charge of the official meteorological work in the Philippines for many years, and his report is comprehensive and detailed. The second report is on volcanoes and seismic centers, and was written by Rev. M. Saderra Masó, assistant director of the Bureau. The islands lie in the volcanic belt which runs from Kamchatka nearly to Australia. They contain many volcanoes, some of which have been in active operation in recent years, and are subject to frequent earthquakes, occasionally severe. An admirable seismic observatory has been maintained at Manila for many years, and this report gives a summary of the information collected at it. Both reports are well illustrated.

The only subject taught in technical schools today, which is of immediate assistance to a new graduate is drafting. A really competent draftsman can always find work, and no engineering student should neglect to acquire rapidity and neatness in the use of instruments. Although he may never have to make a finished drawing, he will be able to direct a drafting room better for knowing the details of the work, while his own sketches will be so clear and accurate that a draftsman can work them out readily. It is interesting to observe what great diversity of opinion exists as to the best methods of giving students this facility in using the chief instruments for expressing their wishes to the men who execute them. Some manuals are little more than collections of graded problems and of instructions on the use of instruments. Others are mainly an explanation of the geometrical principles at the basis of mechanical drafting, leaving to the teacher all the instruction on the technique of drafting. In his "Elements of Mechanical Drawing," Prof. A. P. Jamison has covered all features of the subject. In some respects the book is the most comprehensive yet published, and its only poor feature is the arrangement of the chapters, with the explanation of the use of instruments in the middle of the volume. (New York, John Wiley & Sons; cloth, 8vo, $2.50.)

Few people will recognize in the new edition of Merriman & Jacoby's "Stresses in Simple Trusses," the book that first appeared 17 years ago. In its new form, it is practically a new work, embodying the latest views on the calculation of stresses in elementary structures with those features of previous editions found most satisfactory in interesting and teaching the student. The fundamental principles of computation are explained by referring to roof trusses, which are better adapted for this purpose than bridge trusses. The former classification for bridges has been abandoned and one involving loads has been introduced, so that the dead load stresses, the live load stresses and the stresses due to wind and other causes are treated in separate chapters. The chapter on modern long-span bridges is essentially new, and the whole of the chapter on bracing, members and floors is new. In making these and other changes the book has been nearly doubled in size. The treatment remains the same as before, however, and by frequent references to the literature and history of bridge building the student who takes any real interest in his work is encouraged to hunt up by himself descriptions of important structures and discussions of methods of computation. This journal does not consider that merely descriptive matter is of much value in engineering education, but where it is employed for illustrative purposes, as in this work, its assistance to the student is considerable. (New York, John Wiley & Sons; cloth, 8vo, $2.50.)

The microscope has become such an indispensable instrument in many investigations of direct use to the engineer that the latter is warranted in spending some time in becoming acquainted with it. While no important investigation can be made except by a specialist, some familiarity with the instrument and its uses will be found of value. One of the best books on the subject is the "Elements of Applied Microscopy" of Mr. C. E. A. Winslow. It explains the construction and manipulation of the instrument, the mounting and preparation of objects, micrometry, and the sketching of microscopic objects with entirely satisfactory clearness. It should be pointed out, however, that considerable experience is necessary before any beginner can avoid self-deception in microscopy, even when working under the best instructors. For this reason nobody should expect much success at the outset, particularly if he is working without trained supervision. Two-thirds of the book explains the use of the microscope in connection with starches, foods, drugs, textile and paper fibers, medical and sanitary investigations, court cases, mineralogy, petrography and metallography. The book was written for the beginner, and this aim has been kept in view constantly, making the result a very useful one. (New York, John Wiley & Sons; cloth, 16 mo, $1.50).

Letters to the Editor.

Local Branches of the American Society of Civil Engineers.

Sir: In your issue of June 3 you make some comments on the proposition to form local branches of the American Society of Civil Engineers, which are not altogether in keeping with what I consider the proper view to take of that organization's mission. The constitution of the society states that its objects are the advancement of engineering knowledge and practice and the maintenance of a high professional standard among its members. Nothing is said about any branch of engineering, but the whole wide field is mentioned. The membership includes not only specialists of every sort, but architects, marine architects and anybody qualified to co-operate with engineers in the advancement of professional knowledge. It seems to me that your argument is weak in that it does not recognize the wide range of callings for which the Society's various grades of membership provide, which are broad enough so that everybody qualified for admission to the local engineering clubs, which you praise so highly, is also qualified for admission to some grade of the American Society of Civil Engineers.

It should be understood that the American Society of Civil Engineers makes no distinction between specialists when it uses its influence to maintain the dignity and standing of the engineering profession. While as a body it acts with great slowness and conservatism, its influence has been exerted unofficially, but hardly less powerfully, on a number of occasions with valuable results. Accordingly it is desirable to have all the members of the Society in any district bound together as closely as possible, so that their influence may be the greater in strengthening the position of the organization everywhere. At the present time the local members are not well acquainted and the local branches which are proposed seem to be the only practicable method of bringing them together.

The existing local engineering clubs are largely made up of men who would join the American Society of Civil Engineers if they recognized the comprehensive character of its membership. Some of these clubs might very properly become local branches of the Society, for in this way their influence and standing would be increased, and their dues raised but little. The annual dues of non-resident members are now more than repaid by the excellent publications of the Society, which exceed in amount and value those of any similar organization.

Very truly yours, M. Am. Soc. C. E.

Registration of Architects.

Sir: As the licensing of architects has been made compulsory in the interests of public safety in several American States, it may interest your readers to know that such a course is being strongly advocated in this country, in an indirect manner. British architecture is considered an art by most of the old school of architects; they rank it with music, sculpture and painting, and look upon the manipulation of building materials as the musician regards his technique, the painter his control of pigments and the sculptor his ability in modeling clay. With the great appreciation in the value of real estate, increase in variety of materials for the structural framework of buildings, and the steady rise in the cost of construction, the engineering side of architecture has developed most rapidly. In order that a client may receive the utmost rental from his property, in case it is a large structure, it is absolutely necessary that it should be regarded as a piece of construction as well as a work of art.

There are a good many of us, educated in Germany or in the States, who consider that the failure of the older British architects to recognize the importance of the structural side of their profession is working serious injury to the property owners of the country. It keeps our building laws antiquated, makes our clients waste money in unnecessary masonry, and keeps our steel mills from a profitable revenue. So far as possible, we hope to overcome this condition by a compulsory system of registration which will prevent anybody practicing as an architect who cannot prove himself to possess a sound knowledge of the engineering features of the profession. We are not concerned about the artistic side of architecture in this matter, for we recognize that no system of public licenses or examinations is practicable in judging artistic capabilities, and we do not believe that public safety demands any legal protection against inartistic design. The client must assume the risk of a poor appearance of his building when he retains his architect, but the law should compel all concerned to co-operate in making the building safe for public use.

Unfortunately, the most influential architectural organization in Great Britain, the Royal Institute of British Architects, has not been of any material assistance in this movement to secure registration. Its affairs are largely directed by a council to which eminent architects have been elected in recognition of their work. These older men do not look with favor on anything that will place construction on an equal plane with art in architectural practice. Consequently, in order to have the Institute occupy the position in this movement for sound building which many think it should, it has been considered advisable to put in nomination for the offices to be filled at the coming election men in sympathy with this new view of architecture. We hope they will be elected, although it hardly seems possible, for opinion changes slowly in this country. We have been endeavoring to secure our success in this election by a thorough canvass of the members, and in so doing have drawn down on our heads very severe personal criticism from some of the respected older members of the Institute. As some echoes of these criticisms may have reached the States, I take the liberty of sending this explanation of their cause. F. R. I. B. A.

Liverpool, May 10.

CURRENT NEWS SUPPLEMENT

JUNE 17, 1905.

DIRECTORY OF NATIONAL TECHNICAL SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Annual convention, Cleveland, June 20-23.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Annual convention, Asheville, N. C., June 19-23.

Association of Engineering Societies. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York. Annual meeting, Chicago, July 7 and 8.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St. Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo. Annual meeting, Atlantic City, N. J., June 28 and 29.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, June 29-July 1.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga. Annual meeting, Chattanooga, Aug. 30-31.

AMERICAN AND EUROPEAN MACHINERY IN MEXICO.

By U. S. Consul A. J. Lispinasse, Tuxpam, Mexico.

In view of Mexico's proximity to the United States, it seems strange that American machinery is not exclusively employed by all of the 14,000,000 to 15,000,000 Mexicans—mostly engaged in agriculture and mining—who have occasion to use machinery. On the contrary, they seem to prefer English and German makes, not on account of superior workmanship or cheapness, but apparently because European manufacturers are disposed to conform to their requirements. Furthermore, the Europeans extend long credits, which permit the buyers to proceed leisurely, in conformity with the slow methods employed here in every enterprise.

American machinery is admitted to be excellent, but it is not suited to the rough handling of the unskilled Indians and half-breeds, who, in a majority of cases, perform all kinds of labor here. By most of these a machine is made to perform its duty, regardless of defects which may exist through faulty installation or other causes. The laborers do not stop to take these possibilities into consideration. They cannot appreciate the fine working parts of complicated machinery, nor the careful handling it demands. European machinery is fully one-fourth to one-half heavier than American machinery of the same power, and will stand much rough treatment.

Another source of complaint is that carelessness is displayed by American manufacturers in shipping machinery and accessories, which frequently arrive in very bad condition, requiring the missing parts to be replaced by native mechanics, who thereby jeopardize the working of the machines. The European manufacturer assumes no risk through irresponsible packers or assistants; his products are packed and shipped in a faultless manner, which satisfies his customers, who are quick to appreciate all that this means to them, especially if they are located in some remote section where it is difficult to transport machinery and almost impossible to replace parts that are missing or broken.

By thoroughly canvassing this country American manufacturers will, no doubt, easily overcome these objections, and greatly increase the demand for their machinery of all kinds, which is, notwithstanding criticisms, already held in high esteem. There would be a large field for small motors, pumps, rams, etc., which could be applied to a variety of purposes, such as sawing wood, filling water tanks for stock, and running coffee fanners, cornshellers, decorticating machines, and small cane mills.

In the more important establishments, such as large sugar-cane plantations and stock ranches and mines, there is an unlimited field for the introduction of machinery and mechanical implements of all kinds, about which the average Mexican planter or miner has not the faintest idea, but which he would gladly utilize if brought to his notice by competent and painstaking salesmen, speaking Spanish, and possessing sufficient practical mechanical knowledge to be able to demonstrate how the machine should be operated, so that the unskilled attendant could get a practical illustration of its working.

The following statements are compiled in the Bureau of Statistics, Department of Commerce and Labor, from British and American official publications, and show the exports of machinery and implements from the United Kingdom (calendar year) and the United States (year ended June 30) to Mexico in 1903:

United Kingdom.—Implements and tools, $170,566; locomotives, $70,905; agricultural steam engines, $47,462; other steam engines, $140,773; mining machinery, not steam, $25,856; textile machinery, not steam, $247,306; other machinery, not steam, $318,537; all other machinery, $23,194; total, $1,044,599.

United States.—Agricultural implements, $330,910; machinery, machines, and parts of, not otherwise designated, $4,755,095; sewing machines, $490,238; steam engines, and parts of, $1,692,622; total, $7,262,865; total British, $1,044,599; excess of American machinery, $6,224,266.

In addition to the foregoing, American builders' hardware, saws, and tools, to the value of $704,601, were exported to Mexico during the year. There are no available statistics at hand covering the exports of machinery from Germany to Mexico.

SCRANTON MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The spring meeting of the American Society of Mechanical Engineers, its fifty-first convention, was held at the city of Scranton, Pa., from June 6 to 9, inclusive. The meeting was well attended, and in addition to an instructive selection of technical papers which were presented, interesting excursions to neighboring points of interest in the anthracite coal regions were features of the meeting.

The papers presented at the meeting covered a wide range of subjects, which may, however, be grouped for convenience into four classifications, as follows: Steam Problems; Engines and Turbines; Materials and Machinery, and Miscellaneous. Two of the papers were not original, having been presented at reunion meetings of the society in New York in the winter, being incorporated in the proceedings of the spring meeting for the purpose of record in the transactions.

Engines and Turbines.—An interesting group of papers was presented under this classification. One of these, entitled "Can a Steam Turbine Be Started in an Emergency Quicker Than a Reciprocating Engine of the Same Power?" by A. S. Mann, was reprinted in full on page 661 of the preceding issue of The Engineering Record, while another, entitled "Counterweights for Large Engines," by Prof. D. S. Jacobus, appears in abstract on page 647 of the same issue. The latter paper evoked an interesting discussion of the subject involving references to similar methods that had been pursued in eliminating excessive vibration from large engines. Prof. Jacobus's methods were carefully analyzed and highly commended. Mr. Fred N. Bushnell, chief engineer of the station at Providence, presented in a written discussion additional facts regarding the power plant in question and the causes for the excessive vibration which was encountered.

The paper by W. H. Collier upon "Steam-Actuated Valve Gear" described a promising new form of steam-operated valve mechanism as applied to the valves of a Corliss engine, by means of which the performance of the engine is greatly improved. The most important features of the new system are simplicity and the higher speeds which it makes possible for the engine with Corliss valves, the latter alone making it worthy of consideration. Mr. F. M. Rites, in a written discussion, referred favorably to the new mechanism and pointed out its possibilities.

Steam Problems.—The first paper under this heading was upon "The Transfer of Heat at High Temperatures," by Frank C. Wagner, referring to experiments made by the author to determine the times required to raise the temperature of plates of iron and steel as a basis from which to consider the results in transferring heat into boilers. He concludes as follows:

"One striking result of these tests is brought out by comparing the times required to bring the plate up to the temperature of the furnace. In the muffle tests about three minutes were required, while in the open hearth tests one minute sufficed to heat the plate substantially to the furnace temperature.

"If the law of Stefan holds for the radiation and absorption of heat under practical working conditions, as seems to be the fact, then some very significant relationships exist in the transfer of heat to the heating surface of a steam boiler. Compare two cases where the furnace temperatures are 2,000 degrees and 2,500 degrees Fahr., respectively, and a portion of the heating surface is exposed to direct radiation from the fire. The heats transferred by radiation will be as 37 to 77 in the two cases. In other words, adding 500 degrees to the temperature of the fire more than doubles the radiant heat transmitted to the water in the boiler."

Prof. Chas. H. Benjamin, in a paper entitled "Smoke and Its Abatement," reviewed the entire problem of combustion of coal in steam production in an interesting manner, quoting from his valuable experience as Smoke Inspector of the city of Cleveland, O. He referred to the various methods of smokeless firing, expressing his opinion that the automatic stoker is the most economical solution of the problem. As to types of stokers he highly favored the under feed type, but most strongly recommended the chain-grate type for successful results. He summarized the facts and principles of smoke abatement as follows:

(1) Black smoke is a public nuisance and should be regulated by legal means.

(2) It is the result of imperfect combustion and can be largely abated by proper methods of stoking.

(3) Mechanical stokers offer the best means of accomplishing this result in medium-sized or large plants.

(4) As smoke abatement is a result of better combustion, economy of fuel is the natural and obvious result.

Prof. Benjamin's paper evoked a strong discussion. Mr. J. T. Hawkins and Mr. A. Bement, while commending the paper in general, took issue with him on the point that smokeless combustion entailed greater economy. Mr. Geo. H. Barrus took issue with the conclusions of the paper in that the use of the stoker as recommended is entirely too expensive to render it generally practicable. Mr. Arthur J. Herschman called attention to the fact that smokeless combustion is being obtained in the Fuller (Flatiron) Bldg. in New York City with soft coal. He spoke of the strict ordinances in force in that city against the smoke nuisance, and yet stated that no smoke was perceptible from his chimney. In speaking of the furnace apparatus, he said they had formerly used the Hawley "down-draft" furnaces, but have recently thrown them out and instituted a system of forced draft, which has operated with excellent results. He felt that one feature of his success in smokeless combustion was that of keeping the force-draft air-pressure beneath the grates as nearly equal as possible to the natural draft suction above. He stated his opinion in regard to smokeless firing with soft coal to the effect that there is no economy effected thereby; while it is the very proper thing to do in cities where smoke is a public nuisance, he could not approve Prof. Benjamin's claim that it was very much more economical to secure absolutely complete combustion for avoidance of smoke. In answer to a query he stated that the only difficulty experienced with the system of forced draft in the Fuller Bldg. was the leakage of unconsumed gases, smoke, etc., into the boiler room, effected thereby. Mr. Ambrose Swazey felt that the stoker will be an important factor in smoke abatement, as from his experience firemen are prone to fire in the easiest possible way—which results in smoke. He attributed 75 per cent. of the objectionable smoke produced in Cleveland to be due to careless firing and handling of furnaces. A considerable amount of detached discussion followed, which was in many instances very unfavorable to the stoker. While many opinions were expressed both for and against it, the run of opinion seemed to be against its use except in special cases, where special advantages were to be gained thereby, such as the successful use of a low grade of coal. A very strong preference was expressed in favor of hand firing. It was brought out and made clear that the great economies claimed for the stoker were due to the possibility of using a lower grade of coal than could be burned successfully by hand firing. Upon the same grade of coal, however, it was shown to be economy to fire by hand rather than by stoker.

Two papers were read upon subjects of steam engineering by A. Bement, of Chicago, entitled: "Notes on Efficiency of Steam-Generating Apparatus" and "Performance of a Superheater." The former discussed many points concerning steam boilers which do not seem to have been definitely decided, such as what is meant by such terms as boiler and setting, terms of efficiency of a boiler, furnace efficiency, manipulation, etc. He discussed several of the important factors which have a bearing upon boiler efficiency. Prof. Kent, however, took a strong and decided stand against this paper, stating that he saw little that was of value in it. He could not see the advantage of making the distinction between boiler efficiency and efficiency of a boiler. He made a strong argument against acceptance of the paper and regretted absence of Mr. Bement to defend the paper from criticism. Prof. Kemp felt that the past work of the Boiler Test Committee had fully covered the points of this paper and could not see what further action was necessary unless it could be proven that the Boiler Test Committee's work was in error. Mr. Bement's latter paper was an interesting account of the results obtained in tests of a Babcock & Wilcox superheater under varying conditions. An important feature was the curves presented to show the increase of boiler horse-power with various degrees of superheat.

Materials and Machinery.—A paper upon "The Microstructure and Frictional Characteristics of Bearing Metals," by Melvin Price, gave report of an important series of tests which had been made upon bearing metals. His method, applying the frictional test by an ingenious machine in which the time required for the moving body in frictional contact to come to rest is the measure of the retarding effect, was described, and a table of results of an extensive series of tests was given. The various possible compositions of bearing metal were then investigated for the relation of their frictional characteristics to composition and to microstructure with interesting results. As a result a law was suggested as follows: "The effect of constituents which form hard crystals is constant; the effect of 'silent constituents' varies with the speed," the term "silent constituents" referring to the combinations which do not show up in crystalline form.

The paper by W. J. Keep upon the subject of "Cast Iron: Crushing Loads and Microstructure," presented further information upon this absorbing subject which has been obtained by the author in his indefatigable efforts toward private research in this direction. The results incorporated in this paper are perhaps of more practical importance than any of Mr. Keep's former work in that he records crushing and tensile tests of cast-iron cubes from sides of square test bars, cylindrical sections and columns of varying heights. A series of interesting photo-micrographs was also presented and discussed.

The paper by H. G. Reist, entitled "Notes on Heads of Machine Screws," involved an important discussion of the problem of standardization of machine screw threads, etc., and recommendations were made to the committee of the society at work along this line. The important paper by E. N. Trump upon the "Continuous Measuring and Mixing of Crushed or Powdered Materials in Accurate Proportions" was presented in abstract on page 660 of the preceding issue.

Miscellaneous Papers.—Under this classification an interesting paper suggesting a "Standard Unit of Refrigeration" was read by F. E. Matthews. A standard unit was proposed as the ton of refrigeration, equal to 288,000 b.t.u. of negative heat, equivalent to the melting of 2,000 lb. of ice from and at 32° F., the latent heat of ice being taken at 144 b.t.u. An equivalent standard unit was discussed both for standard and for general conditions, and also the nominal or builders' ratings for compressors. An important feature of the paper was the discussion of methods of testing refrigerating systems, for which suggestions of value were made.

The paper by Dr. Howard T. Barnes upon "Formation of Anchor Ice and Precise Temperature Measurements" was an interesting paper that had been presented at one of the winter reunions of the society at New York and appeared here for purpose of record. In this paper Dr. Barnes gives an interesting account of the difficulties experienced with anchor and frazil ice in the St. Lawrence River in the vicinity of Montreal and outlined the series of temperature measurements that were made to investigate the phenomena.

The paper by Wm. O. Webber, entitled "Some Types of Centrifugal Pumps," was perhaps one of the most important of the meeting in view of the interest taken in it and the discussion provoked. Mr. Webber outlined the important advances that have been made in centrifugal pumping machinery in the last decade and discussed some of the features of the latest designs. The importance of balancing against end thrust was made a strong feature of the paper, and a new design of balanced high-duty pump of this class was illustrated. Formulas governing the action of centrifugal pumps were also discussed. The paper provoked a strong discussion. Mr. Fred Ray took the opposite stand as regards the importance of balancing, suggesting that the satisfactory design of centrifugal pumps lay in many other directions than this. Mr. Ray further stated that in contradistinction to the general opinion, the high-duty centrifugal pumps are *not* adapted to handling of all classes of water and refuse, which he termed "dredging"; for the latter class of work the careful design and high grade of finishing of the high-duty centrifugal pump rendered it particularly inapplicable. Mr. Wm. H. Morse expressed an opinion that the centrifugal pump might be operated to great advantage in connection with the gas engine, the combined efficiencies of these two classes of machinery providing a very economical equipment. He referred to the Schenectady pumping station using centrifugal pumps against high heads, in which tests under his direction showed over 74 per cent. efficiency. While this figure seems rather high on account of representing the most favorable conditions, still he thought that 65 per cent. efficiency could be taken as a fair average for regular operation. Mr. L. A. Zohe doubted the possibility of 74 per cent. and stated that his experience would dictate that 60 per cent. would be high. He thought in all probability in every-day practice these pumps would show nearer to 40 per cent. efficiency. Mr. John R. Freeman was of the opinion that mathematics could have but little to do with the development of centrifugal pumps. He pointed out the fact that anyway mathematics affected only certain local features of the problem, while the harmonizing of all elements could only succeed from a method of "cut and try," rationally applied. He referred to development in similar lines of mechanical work where only in such a way was a successful design obtained. Like Mr. Ray, he doubted the usefulness of the formula presented in the paper.

The paper by W. W. Bird upon "Belt Creep" showed that the question of the minimum amount of slip of a belt in transmitting power from one pulley to another reduces itself to a question of "creep." He described an interesting model upon which he had conducted experiments along this line, and presented a series of results which indicate that the leather belt running under ordinary conditions should not creep to exceed 1 per cent.; while this is sometimes called legitimate slip, it was shown to be an actual loss of power and cannot be avoided by belt tightness or patent pulley coverings.

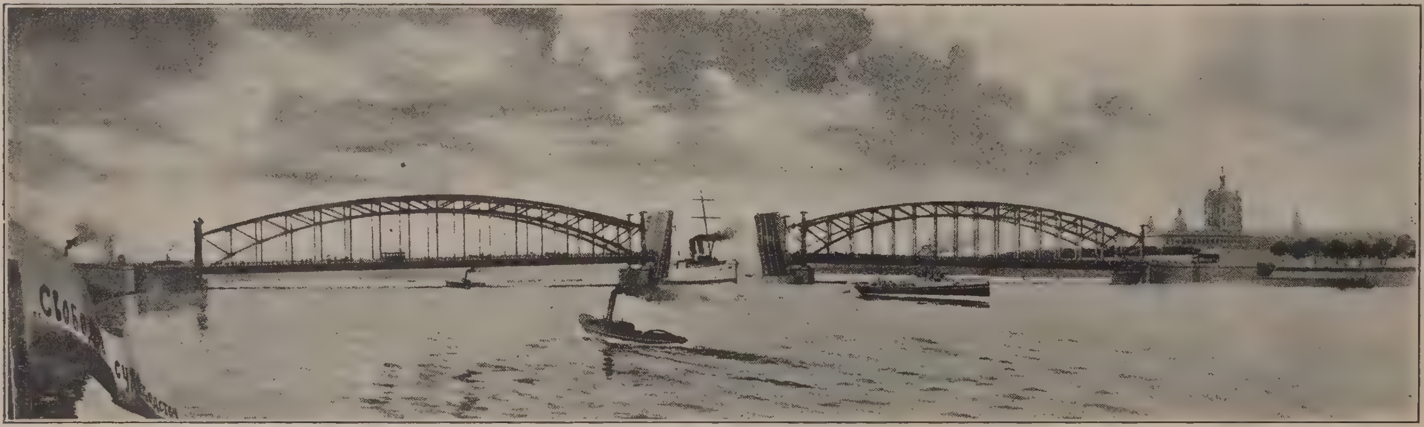
The paper by C. E. Lucke, discussing the "Function of Laboratory Courses in the Curriculum of Engineering Schools," was favorably received, and the tendency of instruction work in this direction was discussed; the desire for even more practical instruction than ever and the placing of the student upon his own responsibility in laboratory and research work was expressed by many. Admiral Melville's paper upon "Epochs in Marine Engineering" was another of the papers which had been presented at one of the winter reunions at the New York headquarters and appeared here for record. A written discussion by John T. Hawkins supplemented the reference in the paper to the development of expansive use of steam by an interesting outline of the work of Sickels in the application of engines operating expansively to naval vessels, who as a pioneer had many interesting experiences in this important branch of steam engineering.

OKHTA BRIDGE AT ST. PETERSBURG, RUSSIA.

The city council of St. Petersburg passed on April 4 a resolution to accept for the construction of the Okhta bridge over the Neva River the design worked out by Prof. Krivoshein and Engineer Apishkoff, which was submitted under the pseudonym, "Freedom of Navigation," for the competition of Sept. 14, 1902, without submission to rules of competition. The board of experts appointed to examine the designs found that this plan deserved attention and should be acquired, owing to the arrangement of the spans and bascules and the conveniences for navigation which the location of the opening part in the middle of the river with two large approach spans (one on either side) would afford. The design was purchased from the authors by the city and will now be worked out in detail for construction.

The general idea of the design is to construct in the middle of the river a rapidly-opening bascule bridge with a span of 42.6 meters and two large approach spans, one on either side, of 150 meters each. The bascule span is designed to open on the system of Engineer M. G. Schinke (two bridges of a similar system are working in Milwaukee, Wis.). The approach spans are designed in the shape of arch trusses with chords of the type of the bridge across the South Elbe at Harburg.

The principal advantages of the accepted design are as follows: 1, Convenience of navigation and the location of the bascules in the middle of the river. 2, The bascule bridge is on the fair-way and the deepest part of the river. 3, The bridge has a minimum number of spans, three, and a minimum number of piers, two. 4, A minimum number of piers presents the least obstruction to the live section of the river and to the passage of small vessels and minimizes the interference with passing ice. 5, The minimum number of expensive piers reduces the cost of the bridge to the lowest figure.


THE ACCEPTED DESIGN FOR THE OKHTA BRIDGE OVER THE NEVA RIVER AT ST. PETERSBURG.

The serviceable width of the bridge is 23.47 meters; that figure contains 17.71 meters for a stone-paved roadway and two 2.88-meter footpaths outside the principal trusses. The span of the approach trusses is 150 meters, consisting of 16 panels of 9.375 meters each. The trusses are 19.21 meters apart on the center line. The piers are to be founded on cofferdams sunk to a depth of 25.5 meters; the abutments will be built on pile foundations at the back of border piling. The piers will be supplied with strong ice breakers, as the ice drift on the Neva is very powerful. The cost of the bridge is estimated at $2,000,000.

TRADE PUBLICATIONS.

The Newhall Chain, Forge & Iron Co., 9-15 Murray St., New York, gives in catalogue 99 a description of cross-arm fittings, guy rods and clamps, step irons, bolts, screws, turnbuckles and other supplies for telegraph, telephone and lighting line work.

The Branch steam trap is described in bulletin No. 11 of the National Equipment Co., St. Louis, Mo. It is a return trap, designed to return against any pressure less than that in it, and special claims are made for its ability to handle large and sudden floods.

The advantages of the Copes automatic boiler feed and house tank regulator are presented in a recent folder of the Central Machine Co., Philadelphia, Pa. The device consists of a feed regulator and pump governor which operate in conjunction to maintain the water level at a predetermined point.

THE AMERICAN SOCIETY FOR TESTING MATERIALS.

The eighth annual convention of the American Society for Testing Materials, at the Hotel Chalfonte, Atlantic City, promises to be one of the most important technical gatherings held for some time. The first session will be held on the afternoon of Thursday, June 29, when some business matters will be transacted and reports will be presented from the following committees: Committee K Gaetano Lanza, chairman, Standard Methods of Testing; Committee O, Paul Kreuzpointner, chairman, Uniform Speed in Commercial Testing; Committee P, Ira H. Woolson, chairman, Fireproofing Materials; Committee Q, Herman von Schrenck, chairman, Standard Specifications for the Grading of Structural Timber.

The second session, on Thursday evening, will be opened by the annual presidential address, which will be delivered by Dr. C. B. Dudley, the subject being the testing engineer. This session will be held jointly with the Society for the Promotion of Engineering Education, and three papers will be presented, as follows: "A Course of Laboratory Instruction in Testing Materials," by Prof. W. K. Hatt; "A Course in the Properties of Materials," by Prof. G. L. Christensen; "Plan and Scope of the Proposed Investigation of Structural Materials Under the Auspices of the U. S. Geological Survey," by Messrs. J. A. Holmes and Richard L. Humphrey.

The third session, on Friday morning, will meet in two sections, as the business to come before the convention makes it absolutely necessary to hold sectional meetings in order to complete the program. The section on cement will be opened with two committee reports, as follows: Committee C, George F. Swain, chairman, Standard Specifications for Cement; Committee I, F. E. Turneaure, chairman, Reinforced Concrete. Six papers are also scheduled for this section: "The Collective Portland Cement Exhibit and the Results of the Tests Made at the World's Fair, St. Louis," by Richard L. Humphrey; "Normal Consistency Tests of Neat Cement," by R. S. Greenman; "Economical Mold for Forming Compressive Test Pieces for Concrete," by Clifford Richardson and C. N. Forrest; "Slow-Pulling, Early-Stage Rotary Portland Cement vs. the Ordinary Early-Strength-Developing Product," by W. A. Aiken; "British Standard Specifications for Cement," by Robert W. Lesley; "Impact Tests of Asphalt Paving Mixtures," by Clifford Richardson and C. N. Forrest. The second section of this session will discuss preservative coatings and will be opened with the following committee reports: Committee E, S. S. Voorhees, chairman, Preservative Coatings for Iron and Steel; Committee N, W. M. Davis, chairman, Standard Tests for Lubricants. Two papers will be read: "Proper Methods in Conducting Painting Tests," by G. W. Thompson; "Protection of Iron and Steel Structures by Means of Paper and Paint," by the late Louis H. Barker. Topical discussions will also be held on standard specifications for preservative coatings for steel and on painting steel cars.

The fourth session, on Friday afternoon, will be opened with the report of Committee A, W. R. Webster, chairman, which will present revised specifications for structural steel for bridges, steel rails, steel castings, steel axles and steel forgings. Committee M, H. V. Wille, chairman, Standard Specifications for Staybolts, will also report, and the following papers will be read: "Some Causes of Failure of Rails in Service," by Robert Job; "Influence of Methods of Piling Staybolt Iron on Vibratory Tests," by H. V. Wille; "Preliminary Report on Tests of Nickel Steel and Carbon Steel Under Combined Stresses," by E. L. Hancock.

Friday evening has been left open for the annual smoker, always a most enjoyable occasion.

The fifth session, on Saturday morning, will be opened with a report from Committee B, Walter Wood, chairman, which will present specifications for car wheels and gray iron castings for discussion. The papers to be read are: "Comparison of Standard Methods of Testing Cast Iron," by Richard Moldenke; "Hard Cast Iron, the Theory of One of Its Causes," by Henry Souther; "The Thermite Process in American Practice," by E. Stuetz.

The sixth and closing session, on Saturday afternoon, will have three committee reports: Committee G, J. Walter Esterline, chairman, Magnetic Testing of Iron and Steel; Committee H, L. W. Page, chairman, Standard Tests of Road Materials; Committee R, E. D. Meier, chairman, Boilers. The following papers will also be read: "A Large Hydraulic Testing Machine for Uniform Loads," by Robert A. Cummings; "Specifications for Cotton Tapes for Electrical Purposes," by R. D. DeWolf; "Rail Sections as Engineering Structures," by P. H. Dudley.

At the risk of seeming to lay undue stress on the importance of this convention, The Engineering Record calls attention particularly to the preceding list of papers and reports as unexcelled in technical interest to engineers since the international congresses at St. Louis. It should be added that the discussions of these papers are often of unusual importance and that the attendance at the meetings is marked by the presence of many of the men whose work is prominently before the engineering public, and who take an active part in the discussions during the meetings.

CONSOLIDATION OF INGERSOLL-SERGEANT AND RAND COMPANIES.

The Ingersoll-Sergeant Drill Co. and the Rand Drill Co. have been united into a new company called the Ingersoll-Rand Co. The new corporation was formed under the laws of New Jersey with a capital of $10,000,000, of which $5,000,000 is preferred stock and the balance common. This is a union of valuable patents and of expert engineers of large experience in this special line of work. The factories of the two companies are located at Phillipsburg, N. J., Easton, Pa., Tarrytown, N. Y., Ossining, N. Y., Painted Post, N. Y., 34th St., New York City and Sherbrooke, Quebec. They will all be operated.

The officers of the Ingersoll-Rand Co. are as follows: President, W. L. Saunders, formerly president of the Ingersoll-Sergeant Drill Co.; Vice-Presidents, Geo. Doubleday, formerly treasurer of the Ingersoll-Sergeant Drill Co.; Jaspar R. Rand, formerly president of the Rand Drill Co., John A. McCall, president of the New York Life Insurance Co., J. P. Grace, vice-president of W. R. Grace & Co., Geo. R. Elder, general manager of the manufacturing department; Treasurer, W. R. Grace, formerly secretary of the Ingersoll-Sergeant Drill Co.; Secretary, F. A. Brainerd, formerly treasurer of the Rand Drill Co.

For the present the main office of the new company will be located at 26 Cortlandt St., New York.

BUSINESS NOTES.

The National Association of Paving Brick Manufacturers was recently organized to conduct a campaign of education concerning the value of brick for street pavements and to furnish information concerning the best methods of laying and maintaining such pavements. The officers of the Association are: W. B. Blair, Terre Haute, president; W. S. Purrington, Galesburg, vice-president; Charles M. Crookes, Youngstown, treasurer; Spencer Doty, Cleveland, secretary.

G. M. Gest, of New York and Cincinnati, has just been awarded the contract for the construction of a complete underground conduit system for the Montreal Light, Heat & Power Co., at Montreal, Can. Over a million feet of conduit are to be used in the construction.

The Roebling Construction Co., Fuller Building, New York, has on hand a large number of contracts for wire lath and furring, fireproofing partition, floor and ceiling work and general fireproof construction. Among them are the fireproofing and ceilings of the new terminal station of the Delaware, Lackawanna & Western R. R., Hoboken, N. J., about $40,000; a brass foundry, including structural steel work, for the Trenton Brass & Machine Co., Trenton, N. J.; an extension of the Fuller Building, New York, which consists of two stories of very light construction built on the present roof; a warehouse for Mr. Frank Brown and a building for the Consolidated Gas Co. of Baltimore, Md.; a building for the Northern National Bank, Sioux City, Ia.; a group of six buildings for the Alexandra Hospital, Montreal, P. Q., $23,000; fireproofing the Holy Trinity Church, Chicago; Pacific States Telephone & Telegraph Co.'s main office building, San Francisco, Cal.; department store for W. H. Frear, Troy, N. Y.; the Kamm store building and the Shreve office building, San Francisco, Cal., $25,000; New York State Armory, Rochester; the first section of a very large store building at Toronto, Ont., for the T. Eaton Co.; fireproofing the addition to the Union League Club building, Chicago; fireproofing the Memphis Trust Co.'s building, Memphis, Tenn.; First National Bank Building and new Law Building, Baltimore, Md.; the Martin Shaughnessey store building, St. Louis; Brooks Casino, theater building, Chicago; factory building for the Harbison-Walker Refractories Co., Mount Union, Pa.; Young Women's Christian Association Building, Providence, R. I.; completing the fireproofing which has been delayed over two years by labor troubles in the 20-story Hotel Belmont, New York; Carnegie Library, No. 3, Amsterdam Ave., New York; Yorkville Bank, New York; U. S. custom house and postoffice at Pierre and another at Deadwood, S. D.; completing fireproofing of Williamsburg power house of the Brooklyn Heights Ry. Co.; just finishing large hotel in Montgomery, Ala., $40,000; Lindell Exchange building for Bell Telephone Co., St. Louis, Mo.

The American Radiator Co. has recently acquired the foundry plant of the Cockshutt Plough Co., at Brantford, Ont. The company will rapidly remodel these works with a view to making therein suitable lines of ideal steam and water boilers, for which a good demand already exists throughout the Dominion. The company will not for the present manufacture radiators there.

The Foundation Co., 35 Nassau St., New York, has recently closed contracts for foundations for the following: Mill for the Farr-Alpaca Co., Holyoke, Mass.; U. S. Barracks, Fort Des Moines, Des Moines, Iowa; engine roundhouse of the C., St. P. M. & O. R. R. Co., Sioux City, Iowa; piers of the new viaduct over the Kaw Valley, Kansas City, Mo. (This contract calls for the installation of between 3,000 and 4,000 concrete piles); bridge over the New Basin Canal at New Orleans, La. The important work which the company has now under way, or is closing up, consists of the following: Piers and abutments for bridge over the Wabash River, at Terre Haute, Ind., for the "Big Four" R. R.; foundations for an extension of the power house of the Union Electric Light & Power Co., St. Louis, Mo.; concrete dock and sea wall for the terminals of the St. L. & Frisco System, at New Orleans, La.

The American Bridge Company has, since March, been receiving new orders for bridge and structural steel work at the rate of about 70,000 tons per month, and, as the release of other work previously held up is now being made at about the same rate, all its shops will be running to their fullest capacity by July 1, and would already be full, except for the delay in receiving materials. Mixed orders require about 3 months for delivery and are supplemented as much as possible from stock. The orders already taken would alone suffice to keep the shops working to their full capacity for eight months, and the prospects are for a continuation of abundant new orders at least until the periodical dull season in the winter. The fifteen plants now operated have a combined capacity of over 50,000 tons per month. About as many more, most of them of less than 500 tons capacity, have been closed since the formation of the company, but one or two of them might be reopened if business demanded it. The most important items of work now in the different plants are as follows: At Toledo, fifty bridges for the Cincinnati, Hamilton & Dayton R. R.; most of them are single-track plate girder spans, but there are a few truss spans, and the whole aggregate 6,000 tons; single-track plate-girder spans for the Harriman lines; two and four-track girder spans for the Pennsylvania Lines west of Pittsburg, and 600 tons of single-track truss span work for the Kansas City, Mexico & Orient R. R. At Trenton, a few bridges for the New York, New Haven & Hartford R. R. and a large number of miscellaneous buildings for New York City, including a boiler shop for the Pennsylvania R. R., the Williams Printing Shop, a building for the Long Island R. R. and the Erie R. R. Ferry House. At Athens the shops are filled with station work, extensions, etc., for the New York Rapid Transit subway. At Edgemoor, 1,500 tons of viaducts and other spans for the Norfolk & Western Ry., 1,500 tons of bridgework for the Philadelphia Rapid Transit R. R., a 400-ton draw span for the Atlantic Coast Line, the 2,200-ton National Museum building at Washington, and two viaducts weighing 1,800 tons for the Pennsylvania R. R. At Shiffler, buildings chiefly for the Pittsburg district, including some for the Tennessee Copper Co., the Frick Coke Co., the National Tube Co., the American Smelting & Refining Co., the Carnegie Steel Co., William Taylor, Sons & Co., Cleveland, and for Atlanta, Ga. At Pencoyd, 20,000 tons for the Wanamaker building, in Philadelphia, and 2,000 tons for the Wanamaker building, New York; 8,000 tons of miscellaneous bridges for the Pennsylvania R. R., the 9,000-ton Altman building, New York; and the 4,000-ton Baltimore & Ohio R. R. Co. building, Baltimore, Md. At Ambridge, 21,000 tons of Grand Central Terminal improvement, New York; the 7,500-ton Washington Terminal Depot, the 12,000-ton Edison Waterside power station, New York; a 3,300-ton single-track, pin-connected bridge for the Northern Pacific Ry.; 40 miscellaneous small bridges for the Buffalo & Susquehanna R. R., weghing up to 500 tons each and including railroad and highway spans; 3,000 tons of track elevation work for the Pennsylvania R. R. lines in Chicago, 4,400 tons of girder and pin-connected truss spans for iprovements of the New York, New Haven & Hartford R. R., and 8,000 tons of buildings for the National Tube Co., McKeesport, Pa. At Brooklyn, a 1,000-ton building for the Day and Night Bank, the 2,700-ton Fisher Building, the Crescent Club building and other New York buildings. At Elmira, about 100 highway spans, 60 railroad bridges for the Erie R. R., a 600-ton store building in Troy, and two bridges, weighing 750 tons, to carry trolley tracks over the railroad tracks in Syracuse.

PERSONAL NOTES.

Mr. John H. Hudson, Jr., has joined the staff of W. R. Grace & Co., Lima, Peru.

Mr. John W. Hill has resigned as chief of the bureau of filtration of Philadelphia.

Mr. R. O. Danenhower has been appointed city engineer of Little Rock, Ark.

Mr. Emery Oliver has been appointed resident engineer on the Western Pacific Ry. at Oroville, Cal.

Mr. B. F. Beckman has been appointed engineer in charge of maintenance of way on the Ft. Smith & Southwestern Ry.

Mr. Robert C. Adams has been apointed hydrographic aid in the U. S. Reclamation Service and will be stationed at Boston, Mass.

Mr. Walter B. Freeman, hydrographic aid in the U. S. Reclamation Service, will be engaged under Mr. C. C. Babb at Browning, Mont.

Mr. Verney W. Russell has received an appointment as engineering aid in the U. S. Reclamation Service and will be engaged at Cody, Wyo.

Mr. Wm. F. Martin, recently appointed hydrographic aid in the U. S. Reclamation Service, will assist Mr. W. B. Clapp at Los Angeles, Cal.

Mr. Albert E. Wood has been appointed engineering aid in the U. S. Reclamation Service and ordered to report to Mr. J. E. Field at Ft. Laramie, Wyo.

Prof. G. S. Williams has resigned as a member of the International Waterways Commission and will be succeeded by Mr. G. Y. Wisner, of Detroit, Mich.

Mr. C. L. Fiske, assistant engineer in charge of the work on the new terminals of the St. Louis & San Francisco Ry. at New Orleans, has been transferred to Texas.

Mr. Carl R. Weitze has been appointed engineering aid in the U. S. Reclamation Service and will be engaged under Mr. C. W. Smith on the Roosevelt dam in Arizona.

Mr. George R. Byrne, of White Plains, N. Y., has become chief engineer of the Bronx Valley Sewer Commission, recently organized to construct an outfall sewer from White Plains to Yonkers.

Mr. Frank H. Drundage, assistant engineer in the U. S. Reclamation Service, and Mr. Ralph C. Soper, engineering aid in the Service, have been ordered to report to Mr. J. Ahern at Cody, Wyo.

Mr. J. C. Herring, Assoc. M. Am. Soc. C. E., has resigned the position of city engineer of Jefferson City, Mo., his successor being Mr. E. F. C. Harding. He will open an office in Jefferson City as civil and consulting engineer.

Messrs. Clayton W. Bowles and Lewis E. Foster have been appointed engineering aids in the U. S. Reclamation Service and ordered to report to Glendive, Mont. Mr. Harold N. Gross, recently appointed assistant engineer in the Service, will also report to Glendive.

Col. T. W. Symons, Corps of Engineers, U. S. A., has been decorated by the Chinese Government with the Order of the Double Dragon, in recognition of his courtesies to Prince Pu Lun during the latter's recent visit to this country. Under our laws, this decoration cannot be accepted without Congressional permission.

Mr. C. H. Ewing, engineer of the Reading and Lebanon divisions of the Philadelphia & Reading Ry., has been appointed engineer of maintenance of way and will be succeeded in his present position by Mr. F. M. Flack, engineer of the Shamokin division of that road. Mr. J. W. De Moyer succeeds Mr. Flack on the Shamokin division.

Capt. E. W. Van C. Lucas, Engineering Corps, U. S. A., has resigned to accept a position as engineer in charge of an industrial plant at Wilmington, N. C. Capt. Lucas graduated from the U. S. Military Academy with the class of 1887, and during the last three years has been in charge of the first and second Mississippi River improvement districts with headquarters at Memphis, Tenn.

Mr. Andrew C. Cunningham, civil engineer, U. S. N., has been appointed assistant chief of the naval bureau of yards and docks during the temporary absence of Rear Admiral M. T. Endicott in Panama. Mr. Cunningham has recently been in charge of construction work at the U. S. Naval Academy at Annapolis.

Prof. George F. Sever, professor of electrical engineering in Columbia University, was conferred with the degree doctor of science at the recent commencement of Columbia University. Mr. Frederick A. Goetze, superintendent of buildings and grounds in Columbia University, was conferred with the degree master of science at the same time.

Dr. George Revay has returned from an extensive European business trip, during which he attended the meeting of the Iron and Steel Institute in London. Dr. Revay came to this country several years ago as an expert on modern coking plants and is now representing the Coppie coke oven in this country. He also follows a general consulting chemical and metallurgical engineering practice at 45 Cedar St., New York City.

Mayor McClellan of New York City has announced the following appointments to the commission on Additional Water Supply for New York City: Messrs. J. Edward Simmons, president of the Fourth National Bank of New York, representing the New York Chamber of Commerce; Charles A. Shaw, president of the Hanover Fire Insurance Co., representing the Board of Underwriters; and Mr. Charles N. Chadwick, president of the Charles N. Chackwick Co., representing the brokers, merchants and manufacturers' associations.

The Mayor of Baltimore has nominated Messrs. Peter Leary, Jr., William D. Platt, Morris Whitridge, Ira Remsen, Charles England and J. Edward Mohler members of the commission which will have charge of the sewerage works of the city. The mayor will be an ex-officio member. Gen. Leary is a retired officer of the army, Mr. Pratt is engaged in the oyster industry, Mr. Whitridge is a merchant, Dr. Remsen is the eminent chemist at the head of Johns Hopkins University, Mr. England is a grain merchant and Mr. Mohler is a manufacturer of plumbers materials.

Messrs. Alfred Craven, Edward Bond, E. L. Corthell, J. A. L. Waddell and J. L. Harrington have been named as an advisory board of consulting engineers to the American backers of the all-rail route via Alaska and a tunnel under Behring Straits to Siberia. This is the undertaking which M. Loicq de Lobel has been promoting for some time. Surveys will be started at once by Mr. Waddell. The total length of the tunnel and approaches will be 38 miles. The connections with the Trans-Siberian Ry. will be 3,800 miles long. On the American side the connection between the tunnel and the Grand Trunk Pacific Ry. will be 1,200 miles long.

Mr. W. S. Heger has become assistant to the vice-president and general manager of the Allis-Chalmers Co., with headquarters in the general offices of the company at Milwaukee. Mr. Heger graduated from Stevens Institute with the class of 1879 and shortly afterward entered the mechanical drafting room of the Edge Moor Iron Works. When that company received the contract for the Brooklyn Bridge Mr. Heger was placed in charge of putting the steel work through the drafting room, shops and the testing and inspection departments. In 1885 he began a contracting and electrical engineering practice and later became sales agent and constructor of isolated lighting for the Edison Company in Delaware, Maryland, the Virginias and the Carolinas. In 1889 Mr. Heger was sent to San Francisco as district manager of the Pacific Coast territory of the Edison Company and for the Edison United Mfg. Co. He became general manager of the Wilmington City Ry., Wilmington, Del., in 1892 and after three years in that position returned to the Pacific Coast as district manager for the Westinghouse Electric & Mfg. Co., with headquarters at San Francisco. Mr. Heger resigned his position with the Westinghouse Electric & Mfg. Co., in April.

The departure of Mr. Luigi Luiggi from Argentina, where he has been engaged for nine years in harbor improvements, was marked by many public farewell ceremonies. The large and influential Italian colony in the country presented him with a gold medal having his bust on the obverse side and the following inscription in Italian on the reverse: "His countrymen in Argentina, under the auspices of 'La Patria degli Italiani,' with devotion and affection, to the Engineer Commendatore Luigi Luiggi, who honored them, and who leaves in a hospitable country a distinguished work, the military post of Bahia Blanca." A second gold medal bears on the obverse a view of the harbor at Bahia Blanca with the motto, "mens agitat molem," and on the reverse the inscription: "Offered to the Engineer Commendatore Luigi Luiggi by the Italians of Bahia Blanca, witnesses of his struggles and triumphs in the general creation of the military port, in remembrance of their admiration. A third gold medal was presented by the municipality of Bahia Blanca. On the obverse is a view of the harbor and the motto, "ciencia-labor-constancia;" the reverse bears the inscription, in Spanish, "July 2, 1896—January 2, 1905; the municipality of Bahia Blanca to the Engineer Luigi Luiggi."

A meeting of prominent engineers and officials of the U. S. Geological Survey and of the Bureau of Forestry was recently held in Washington to discuss the problems connected with the testing of structural materials. The following were in attendance at the meeting: Dr. C. B. Dudley, chairman of the conference, President American Society for Testing Materials, chief chemist, Pa. R. R.; C. C. Schneider, pres. American Society of Civil Engineers; R. L. Humphrey, pres. American Society of Cement Users and cement expert U. S. Geological Survey; R. W. Lesley, vice-pres. American Society for Testing Materials, editor Cement Age; G. S. Webster, chief engr. City of Philadelphia; E. A. Foose, representing Mr. J. E. Muhlfeld, gen. supt. of motive power, Baltimore & Ohio R. R.; E. F. Kenney, representing Mr. Jos. T. Richards, chief engr. Pennsylvania R. R., Philadelphia; Mr. Burleigh, representing Mr. James K. Taylor, suprev. archt. of the Treasury Dept.; A. F. Robinson, representing Mr. James Dunn, chief engr., Santa Fe Ry., Chicago; D. W. Lum, chief engr. Southern Ry.; W. C. Cushing, chief engr. Pa. Lines west of Pittsburg; J. F. Deems, gen. supt. of motive power, New York Central & Hudson River Ry.; O. H. Buckingham, supervisor of fuels, New York Central & Hudson River Ry.; J. E. Greiner, representing Mr. D. D. Carothers, chief engr. Baltimore & Ohio R. R.; F. H. Newell, chief engr. Reclamation Service; Gifford Pinchot, forester U. S. Dept. of Agriculture; Prof. J. A. Holmes, in charge of testing work of the U. S. Geological Survey; W. L. Hall, in charge of testing work for Bureau of Forestry. Arrangements have been made for a continuous advisory board to work with the Bureau of Forestry and the Geological Survey in the conduct of their official tests. This co-operation will mean that in advance of any tests these Bureaus will have the benefit of the suggestions and advice of the foremost engineers of the country in special lines of work. It is the first time that such co-operation has been effected, and it is believed that the relations thus established will result in more expeditious and satisfactory work. The initial work, that of analyzing and testing the relative steam producing powers of coals and lignites of the United States, which was inaugurated during the summer of 1904, at St. Louis, will also be continued.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Idaho Springs, Colo.—Bids will be received until July 6 by Chas. Brandstetter, City Clk., for $75,000 bonds for extending the system of water works.

Boulder, Colo.—Bonds to the amount of $75,000 are reported sold, to be used for water works improvements. J. P. Maxwell, City Engr.

East Hartford, Conn.—The Senate has reported favorably on the petition of Clarence E. Jones and others for a charter to supply water to New Hartford.

**Wilmington, Del.*—The Bd. Water Comrs. is stated to have on June 12 awarded the contract for a 12,000,000-gal. pump for the new pumping station to the Holly Mfg. Co., of Buffalo, N. Y., for $79,769 (bids opened June 5).

Washington, D. C.—Bids will be received June 29 by Lieut. Col. Smith S. Leach, Corps Engrs., U. S. A., for furnishing all materials except Portland cement and constructing 29 concrete-steel sand bins for the Washington Aqueduct (D. C.) filtration plant. Allen Hazen, Engr., St. Paul Bldg., New York, N. Y.

Thebes, Ill.—Engr. R. H. Phillips, of St. Louis, Mo., is reported to have estimated the cost of water works for Thebes at $15,700.

Mt. Olive, Ill.—Bids are wanted June 20 for furnishing material and constructing water works, as advertised in The Engineering Record.

La Salle, Ill.—It is proposed to lay several blocks of 6-in. water pipe. C. M. Rickard, City Engr.

East Moline, Ill.—W. F. Kimball, of Davenport, Ia., is stated to have been selected to prepare plans for water works and a sewerage system.

Montpelier, Ind.—See "Power Plants, Gas and Electricity"

Valley Junction, Ia.—See "Power Plants, Gas and Electricity."

Henderson, Ky.—The City Council is stated to have elected a new Water Wks. Bd. and directed the Board to employ an expert to investigate the feasibility of establishing a system of artesian wells, providing the city with a pure supply of water.

Vidalia, La.—Bids will be received until June 20 by John S. Boatner, Mayor, for furnishing, f. o. b. Vidalia, a duplex pump, elevated water tower triplet pump and electrical motor and 6,600 ft. 6-in. c. i. pipe. M. Griffin O'Neil, Engr., 506 N. Texas Bldg., Dallas, Tex.

Brockton, Mass.—Chas. R. Felton, City Engr., is now preparing a report on a high service water supply. The additional pressures required will probably call for an additional standpipe and new boiler plant.

**Southbridge, Mass.*—The contract for constructing 2 storage reservoir dams on Hatchett Brook (bids opened June 6) has been awarded to Blanchard Bros., of Linwood. Engineers, Moore & Smith, 44 Front St., Worcester.

Battle Creek, Mich.—W. W, Bridgen, Water Wks. Supt. & Engr., writes that it is proposed to procure a new water supply, but nothing definite has yet been done. May use old supply and filter same, or put in new well system.

Pine City, Minn.—Oscar Claussen, of St. Paul, is reported to be preparing plans for water works and a sewerage system for Pine City, to cost about $17,000.

St. Cloud, Minn.—The Water Wks. Com. is reported to have in contemplation the installation of electric pumps and a dynamo for the operation of the water works.

**Nashwauk, Minn.*—Paul H. Toedx, Village Recorder, writes that the contract for constructing water works (bids opened June 5) have been awarded to Dowling Bros., of Eveleth, for $18,934.

Clinton, Minn.—Bids will be received until July 3 by the Village Council (J. L. Erickson, Pres.) for $6,000 water works improvement bonds.

Boonville, Mo.—Chas. G. Miller, City Clk., writes that Burns & McDonnell, of Kansas City, have been selected to prepare plans for water works, to cost $20,000.

Kansas City, Mo.—Bids will be received by the Bd. Pub. Wks. (Everett Elliott, Secy.) for furnishing and delivering f. o. b. cars, Kansas City, the annual supply of c. i. pipe and special castings.

North Platte, Neb.—See "Miscellaneous."

Clementon, N. J.—The Clementon Water Co., of Camden, has been incorporated, to maintain water works in the township of Clementon; capital, $125,000. Incorporators: Edw. W. Hunt, Kirkwood; Walter E. Hunt and Chas. R. Stevenson, Haddonfield, and Albert M. Felter, Philadelphia, Pa.

Deal, N. J.—See "Power Plants, Gas and Electricity."

**Newark, N. J.*—The following are the bids opened June 8 by the Street and Water Comrs. for (*a*) 585 tons 4 to 8-in. pipe, (*b*) 620 tons 10 to 16-in. pipe, (*c*) 75,000 lb. specials, (*d*) total: Warren Fdry. & Mchy. Co., 170 Bway, New York, N. Y., *a* $28.20, *b* $28, *c* 2½ cts., *d* $35,732 (awarded contract); U. S. Cast Iron Pipe Fdry Co., Philadelphia, Pa., *a* $29.15, *b* $28.15, *c* 2½ cts., *d* $36,381; John Fox & Co., New York, N. Y., *a* $29.50, *b* $28.60, *c* 2½ cts., *d* $36,864; Camden Iron Wks., Philadelphia, Pa., *a* $30.40, *b* $28.40, *c* 2⅝ cts., *d* $37,361.

**Items marked thus give the names of parties awarded contracts.*

Glendive, Mont.—The following are the detail bids of the four bidders, who submitted bids on all the excavation and structures of all four divisions of the 34 miles of canal to be constructed near Glendive, to be known as the Ft. Bueford project, N. Dak. and Mont. (N. H. Savage, Superv. Engr., F. E. Weymouth, Project Engr.: (*a*) The Widell-Finley Co., Mankato, Minn., (b) Foley & Larson, St. Paul, Minn., (*c*) C. A. Warren & Co., San Francisco Cal., (*d*) Jas. Forrestal & Co., St. Paul, Minn.:

	a	*b*	*c*	*d*
3,612,000 cu. yds. excav., Class 1	$.14	$.19	$.20	$.21⅓
6,500 cu. yds. excav., Class 2	.28	.30	.45	.75
6,000 cu. yds. excav., Class 3	.45	.35	.45	.75
3,530 cu. yds. excav., Class 4	.97	.75	1.40	6.25
3,400 cu. yds. wet excav. at headworks	1.25	1.25	2.00	1.00
20,000 cu. yds. wet excav. in canal	.30	.65	1.75	.70
393,000 cu. yds. overhaul, per 100 ft.	.01½	.01	.01	.03
7,000 cu. yds. refilling	.25	.50	.40	.20
6,000 cu. yds. puddling	.50	.65	2.00	.25
18,210 cu. yds. riprap	2.00	2.25	2.50	4.65
6,340 cu. yds. concrete, Class 1	2.70	12.00	10.50	10.00
5,210 cu. yds. concrete, Class 2	2.55	6.50	8.50	8.00
640,000 lbs., placing steel for concrete reinforcement.	.04	.00$^{7}/_{10}$	.01¾	.01½
100,000 lbs., placing gates at headworks	.07	.01¼	.02	.01
7,900 lin. ft. piles, delivered	.30	.22	.28	.18
7,500 lin. ft. piles, driven	.21	.20	.40	.20
163.8 M. ft. sheet piles, delivered	21.75	30.00	43.00	32.00
5,000 lin. ft. sheet piles driven, Class A	2.00	.15	.40	.10
26,090 lin. ft. sheet piles, driven, Class B	1.00	.15	.60	.07
54 M. ft. lumber	22.25	35.00	45.00	32.00
39,800 lbs. steel	.06	.08½	.10	.04
1,300 lbs. cast iron	.05½	.07½	.09	.04
110 lin ft. 8-in. terra cotta pipe	.45	.35	.50	.50
600 lin. ft. 24-in. terra cotta pipe	1.95	2.50	4.00	4.00
840 lin. ft. 30-in .terra cotta pipe	3.45	3.95	5.50	5.00
1,200 lin. ft. 36-in. terra cotta pipe	5.45	5.85	8.00	7.00
Total	$691,859	$908,267	$1,016,188	$1,063,361

Glendive, Mont.—Bids were opened June 1 at the office of U. S. Reclamation Service, Glendive, for the construction of about 34 miles of canal near Glendive (Ft. Buford project, N. D. and Mont.). H. N. Savage, Super. Engr.; F. E. Weymouth, Project Engr. Bids were submitted separately for excavation and for structures under four divisions, also as a whole, and the following are the totals of bids received:

(*a*)—The Widell-Finley Co., Mankato, Minn.
(*b*)—Callahan Bros., Phelan and Shirley, Omaha, Neb.
(*c*)—Chas. Stabern, Helena, Mont.
(*d*)—The Deadwood Cons'n Co., Deadwood, S. Dak.
(*e*)—Griffith & McDermott, Chicago, Ill.
(*f*)—Orman & Crook, Pueblo, Colo.
(*g*)—Cotton Bros. & Co., Oakland, Cal.
(*h*)—Jas. Forrestal & Co., St. Paul, Minn.
(*i*)—C. A. Warren & Co., San Francisco, Cal.
(*j*)—W. J. Bradshaw, Helena, Mont.
(*k*)—Foley & Larson, St. Paul, Minn.
(*l*)—Duncan McKenzie, Great Falls, Mont.

Division No. 1—(1) excav. (2) structures—(*a* 1) $163,367 (*a* 2) $54,702, (*b* 1) $165,237, (*c* 2) $40,942, (*d* 2) $47,699, (*e* 1) $178,402, (*f* 1) $185,655, (*g* 1) $213,317, (*g* 2) $76,713, (*h* 1) $278,565, (*h* 2) $65,193, (*i* 1) $289,080.

Div. No. 2 (1) excav., (2) structures—(*e* 1) $197,060, (*a* 2) $54,830, (*b* 1) $159,800, (*c* 2) $38,828, (*d* 2) $43,270, (*e* 1) $161,537, (*f* 1) $161,411, (*k* 1) $248,040, (*h* 2) $78,506.

Div. No. 3, (1) excav., (2) structures—(*a* 1) $193,827, (*a* 2) $34,447, (*b* 1) $140,919, (*c* 2) $24,611, (*d* 2) $28,641, (*e* 1) $159,248, (*f* 1) $159,351, (*h* 1) $239,070, (*h* 2) $46,797.

Div. No. 4, (1) excav., (2) structures—(*a* 1) $63,896, (*a* 2) $33,933, (*b* 1) $56,039, (*d* 2) $28,142, (*e* 1) $66,965, (*f* 1) $66,621, (*h* 1) $68,140, (*h* 2) $46,325, (*f* 1) $92,716.

Div. Nos. 1, 2, 3 and 4. Totals of all four divisions, (1) excav., (2) structures—(*a* 1) $567,536, (*a* 2) $165,414, (*e* 2) $149,918, (*f* 2) $184,630, (*g* 2) $181,212, (*h* 1) $825,585, (*h* 2) $233,126, (*i* 1) $790,525, (*l* 2) $180,558.

The total bids for all excavation and all structures on the four divisions were—(*a*) $691,859, (*k*) $908,267, (*i*) $1,016,188, (*h*) $1,063,361.

Camden, N. J.—This city will lay about 800 ft. of 36-in. pipe from pumping station to river for extra fire protection.

New York, N. Y.—See "Miscellaneous."

New York, N. Y.—Mayor McClellan has appointed J. Edw. Simmons, Chas. A. Shaw and Chas. N. Chadwick as the Municipal Water Comn., which will have full charge of the proposed $100,000,000 improvement of the city's water supply.

Despatch, N. Y.—The Despatch Water Co. has been incorporated, with a capital of $5,000, by Chas. D. Brown, Rochester; Chas. A. Greene, Penfield, and Jos. H. Snow, Fairport.

Rochester, N. Y.—Local press reports state that it is estimated that it will cost about $20,000 to pipe the city water to Genesee Valley and Seneca Parks.

Buffalo, N. Y.—Separate bids will be received until June 28 by the Bd. Pub. Wks. (Francis G. Ward, Comr.) for c. i. pipe and castings 3 to 48 in. in diam.; valves and hydrants, all sizes; valve and service boxes, hanhole frames and covers, vault covers and corporation cocks.

**Buffalo, N. Y.*—The Allis-Chalmers Co., of Milwaukee, Wis., is stated to have secured the contract for a 25,000,000-gal. electric pump for the water works station (bids opened May 17) for $26,600.

**Scotia, N. Y.*—The following are reported to be the bids opened by the Village Trus. June 5 for laying water mains: Jos. H. Clements, Schenectady, $7,765 (awarded contract); Stevenson Bros., $10,343; Beckwith Bros., $12,612; C. M. Gridley, $7,798; De Graffe Bros., $8,153; Kellam & Shaer, $8,538; Thos. Crane, $7,985; W. M. Stanton, $8,368; T. W. O'Day, $8,770; F. Besh, $11,823; Hinman & Sprohl, $10,973, and Mr. McCann, $7,941.

Newburg, N. Y.—The Water Bd. is reported to be considering the laying of an 8-in. water main in Lander St. from Bway to South St.; probable cost of work, $5,000.

Morehead City, N. C.—See "Power Plants, Gas and Electricity."

Wahpeton, N. D.—See "Schools."

Bellaire, O.—It is reported that bids will be received until June 20 by the Bd. Pub. Service (J. A. Jackson, Clk.) for constructing a mechanical filtration system; probable cost, $35,000.

Fremont, O.—The citizens are reported to have voted June 5 to issue $30,000 bonds to improve the water works and the Fire Department service.

Fredericktown, O.—It is reported that water works will be installed here.

Columbus, O.—The Panhandle R. R. (Thos. Rodd, Ch. Engr., Pittsburg, Pa.) is reported to be considering the construction of a pumping station on Big Walnut Creek, also a water purifying plant in the 20th St. yards.

**Cincinnati, O.*—The Water Wks. Comrs. are reported to have on June 5 relet the contract for laying c. i. pipe in Reading Road to Frank Burns for $9,428.

Cleveland, O.—It is stated that bids will be received until June 20 by the Bd. Pub. Service (A. R. Callow, Secy.) for furnishing f. o. b. cars at Kirtland St. pumping station engines and generators.

Panama.—Bids will be received until July 10 by the Isthmian Canal Comn. at Washington, D. C. (D. W. Ross, Gen. Purchasing Agt.), for furnishing water pipe and pipe fittings, sanitary fixtures and roughing material, pig lead, hydraulic jacks, etc.

Panama.—Bids will be received by the Isthmian Canal Comn., Washington, D. C., on July 17 for valves, water columns, pipe and pipe fittings, etc., as advertised in The Engineering Record.

Williamsport, Pa.—W. H. Bloom, Gen. Mgr. Williamsport Water Co., writes that the stockholders on June 6 voted to increase the capital stock of the company from $400,000 to $750,000. Contracts for work contemplated at the pumping station have been let, with the exception of a well 30x30 ft., which has not yet been contracted for.

Kittanning, Pa.—The Council has granted the Citizens' Water Co. a franchise to lay water mains and furnish water in the borough.

East Greenwich, R. I.—At the annual meeting of the Fire District June 5 the taxpayers voted to authorize the Water Com. (Saml. M. Knowles, Chmn.) to execute a contract for a water supply with any company satisfactory to the committee, and if a fair contract cannot be made, power was given the committee to obtain bids for a new plant. It is stated that if contract is renewed with the East Greenwich Water Supply Co. a filter plant will be installed.

Yuma, Ariz.—The following are the bids opened June 5 at the office of J. B. Lippincott, Superv. Engr., U. S. Reclamation Service, 1108 Braly Bldg., Los Angeles, Cal., for the construction of Laguna Dam and sluiceways for the diversion of part of Colorado River, 10 miles n. e. of Yuma. (Homer Hamlin, District Engr., Yuma, Ariz.): (*a*) P. McDonnell, Duluth, Minn., (*b*) R. W. Faris, Faris-Kesl Contr. Co., Boise, Idaho, (*c*) Pacific Constr. Co., San Francisco, Cal., (*d*) N. S. Sherman Machinery Co., Oklahoma City, Okla. Ter., (*e*) J. G. White & Co., 43 Exchange Place, New York, N. Y., (f) Cotton Bros. & Co., Oakland, Cal., (*g*) City Street Improv. Co., 512 Mills Bldg., San Francisco, Cal., (*h*) Burrell Constr. Co., Oakland, Cal.:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
305,000 cu. yds. rock excav., Class 1	$1.30	$1.25	$1.05	$1.40	$1.30	$1.05	$1.23	$1.20
282,000 cu. yds. earth excav., Class 2	.23	.50	.30	.40	.30	.63	.38	.60
305,000 cu. yds. rock in dam	.50	.40	.70	.60	.35	.28	.40½	.09
80,000 sq. yds. pavement	1.00	1.00	1.50	2.00	1.00	1.12	1.00	.90
27,150 cu. yds. concrete	4.00	4.00	4.00	4.45	4.00	5.50	4.65	5.00
53,000 lin. ft. sheet piling	.40	.55	.37	.50	.40	.48	.329	.55
Total	$823,600	$862,000	$866,560	1,030,117	$797,650	$847,675	$829,519	$799,550

Nashville, Tenn.—Floyd Davis, of Des Moines, Ia., will probably be engaged by the Bd. of Pub. Wks. to analyze and investigate the city water supply.

Franklin, Tenn.—The citizens voted May 31 to issue $15,000, in addition to the $50,000 bonds previously voted, for building a gravity system of water works. Address Kirkpatrick & Johnson, Engrs., Jackson.

Clifton, Tex.—The citizens are reported to have voted to issue $6,000 bonds for water works.

Dallas, Tex.—D. F. Sullivan, Supt. Water Dept., is stated to have submitted to the Water Comrs. recommendations for the improvement of the distribution system, at a cost for large pipe alone of about $86,520.

Coleman, Tex.—This city will probably expend about $10,000 in improvements.

Pleasant Grove, Utah.—The citizens are reported to have under consideration the establishment of water works.

Warrenton, Va.—The citizens on June 13 voted to issue $23,000 bonds for the construction of a 3,000,000-gal. reservoir and appurtenances, as recommended by Engr. Howard Murphy, of Warrenton.

Seattle, Wash.—The Council Com. has decided to call for bids for bonds to the amount of $450,000, to be expended in improving the water service of the city. Council is also reported to have decided to follow the recommendation of Engr. J. T. Fanning and immediately begin the construction of the large main to come into the city from the pumping station via Mission Ave. to Division St.

Laconner, Wash.—The Chamber of Commerce is stated to have decided to petition Council to submit to the voters the question of installing municipal water works.

**Ft. Wright, Wash.*—The Burrell Constr. Co., of Portland, Ore., is reported to have secured the contract for constructing water works at Ft. Wright for $16,942.

**Wauwatosa, Wis.*—The contract for extending the water works is stated to have been awarded to C. J. Crilley, of Milwaukee.

Sheridan, Wyo.—W. S. Metz, of Sheridan, State Agt. and Vice-Pres. Kearney Lake Land & Reservoir Co. and the Big Horn Reservoir Co., writes that from $15,000 to $25,000 will be expended in improvements. Engineer, E. Lillittle, Sheridan.

**Strathcona, Alta, Canada.*—Dietz & Main are reported to have secured the contract for constructing water works and sewers (bids opened May 29), for $51,130.

**Toronto, Ont.*—M. J. Haney is stated to have secured the contract for constructing the water tunnel under the bay (bids opened June 6) for $269,000.

Meaford, Ont.—It is stated that bids will be received until June 26 by J. G. Clarke, Chmn. Water Works Com., for erecting a 40-ft. steel tower and steel storage tank, with pipes, valves, etc. Bids are to be submitted on a tank having a 50,000-gal. capacity and also on one having an 80,000-gal. capacity.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Troy, Ala.—The City Council is reported to have decided to construct a sewerage system.

**Pine Bluff, Ark.*—The Robinson Bros. Plumbing Co., of Pine Bluff, are reported to have secured the contract for constructing about ¾ miles of sewer in the west end of city, from 10th to 20th Ave. and from Elm to Mulberry St. (bids opened May 31) for $12,105.

**Denver, Colo.*—The following are reported to be the bids opened May 27 by the Bd. of Pub. Wks. for the construction of the Highlands special sanitary sewer: The Colorado Co., $54,661; Denver & Pueblo Constr. Co., $55,328, and Gaffey & Keefe Constr. Co., $54,000 (awarded contract).

Bridgeport, Conn.—Bids are wanted July 1 for construction of about 1,000 ft. of 48-in. iron round brick sewer in William St., as advertised in The Engineering Record.

Torrington, Conn.—Bids will be received until June 20 by the Boro. Wardens and Burgesses for constructing sewers and appurtenances in portions of several streets. Bernard E. Higgins, Boro. Clk.

Washington, D. C.—D. E. McComb, Supt. of Sewers, writes that the following are the bids opened June 13 for sewers in Dist. of Columbia: (1) Sewer A, (2) Sewer B: Jas A. Coyle, Washington, (1) $3,948, (2) $7,533, and E. G. Gummel, Washington, (1) $3,954, (2) $6,104.

Quitman, Ga.—Bids are wanted June 28 for furnishing material and constructing a system of sanitary sewers, as advertised in The Engineering Record.

Bloomington, Ill.—See "Paving and Roadmaking."

East St. Louis, Ill.—W. J. Crocken, City Engr., writes that bids will be received June 20 for sewers and paving in Trendley Heights; probable cost of work, $24,000.

East Moline, Ill.—See "Water."

Gas City, Ind.—W. D. Hunt, City Clk., writes that the question of constructing sewers is under consideration, to cost from $12,000 to $25,000.

Denison, Ia.—The City Clk. writes that it is proposed to construct 8-in. vitrified pipe sewers, but estimates have not yet been completed.

**Des Moines, Ia.*—The following are reported to be the bids opened May 30 by the Bd. of Pub. Wks. for constructing the Ingersoll Run sewer: Des Moines Bridge & Iron Wks., $54,600; J. F. Griffith, $59,500; King-Lambert Constr. Co., $53,845; O. P. Herrick, $46,450; J. W. Turner, $49,900; W. F. Cook, $53,197; Christy Constr. Co., $45,000, and Jas. Horrabin, $39,000 (awarded contract.

**Items marked thus give the names of parties awarded contracts.*

Plainfield, N. J.—The following are the totals of bids opened by City Council, June 5, also figures on some of the principal items required in connection with the enlargaing in the sewage disposal works. Andrew J. Gavett, City Engr.)

	Filling material			Concrete—2,750 cu. yds.	Concrete roof over septic tank.	Total.
	Stone.	Slag.	Cinder.			
	13,200 cu. yds.					
Richards & Gaston, New York, N. Y.	$1.50	$1.50	$1.50	$5.50	$9,000	$52,047
Schimmel & Heil, Easton, Pa.	1.87	1.83	1.60	5.15	6,000	52,612
Jas. Maybury & Son, Passaic	2.00	1.80	1.80	5.40	15,000	53,213
Jacob Jacques & Michael De Rosa, Elizabeth	1.60	1.60	1.60	7.50	1,600	53,391
Miller-Collins Co., New York, N. Y.	1.85	1.65	—	5.70	8,470	55,581
Hillpott & McCabe, Jersey City	1.94	1.94	1.94	5.90	5,987	56,054
Bunting Constr. Co., Long Island City	1.90	1.90	1.90	5.75	6,000	57,501
Goodwin Constr. Co., New York	1.66	1.66	—	6.75	6,560	57,570
C. L. & G. A. McKeag, New Brunswick	1.85	1.85	—	5.85	7,800	57,968
Crouse Constr. Co., Perth Amboy	1.63	1.53	1.53	6.48	6,367	58,993
Neff Co., New York, N. Y.	2.20	1.90	—	6.20	6,000	60,823
Finch-Anderson Co., Glens Falls, N. Y.	2.19	—	—	7.10	—	61,572
Cement Paving & Constr. Co., Jersey City	1.90	1.84	1.84	7.93	5,600	61,840
Middlesex Contr. Co., New Brunswick	2.04	2.04	2.04	6.35	5,458	62,482
Stacy B. Opdyke, Jr., Dunellen	1.95	—	—	7.50	6,430	64,110
Frank Pidgeon, Saugerties, N. Y.	2.45	1.80	—	7.85	12,000	65,112
Bell Eng. & Constr. Co., New York, N. Y.	1.95	1.85	1.79	7.30	7,337	65,655
Gallery & Murphy, Wilmington, Del.	1.92	1.92	2.00	8.25	6,700	67,045
Bid not signed; check signed by D. Cuozzo, New York.	1.90	1.90	—	7.50	5,000	66,230
Mfgrs.' Contr. Co., Wilmington, Del.	2.27½	1.89½	—	8.25	5,499	71,265

Abilene, Kan.—Bids will be received until July 7 by M. R. Jolly, City Clk., for constructing main sewer No. 3 and lateral sewers Nos. 16, 17, 18, 18a, 20 and 20a. Burns & McDonnell, Engrs., Dwight Bldg., Kansas City, Mo.

Hopkinsville, Ky.—The Hopkinsville Sewerage Co. has been incorporated, with a capital of $50,000, by R. C. Hardwick, Jas. West, C. B. Petrie and others. The company proposes to put in at once a sewerage system under a franchise recently secured.

Louisville, Ky.—City Engr. J. F. Breed is stated to have completed and presented to Mayor Grainger and the Bd. of Pub. Wks. his report on the sewer to drain the southern and southeastern part of city.

Baltimore, Md.—Gen. Peter Leary, Jr., Wm. D. Platt, Morris Whitridge, Dr. Ira Remsen, Chas. England and J. Edw. Mohler have been appointed as a commission to have supervision of the expenditure of $10,000,000 for a sewerage system.

Duluth, Minn.—Several miles of sanitary sewers will be constructed by the city this year in small sections of from 300 ft. to 2,300 ft.

Easements condemnation proceedings for enclosing Brewery Creek have been ordered, to make a trunk sanitary sewer. If steps are successful, 1,100 lin. ft. will be enclosed in a semi-elliptical concrete culvert, with horizontal axis 6 ft. 8 in. and vertical semi-axis 5 ft. 6 in.

Pine City, Minn.—See "Water."

St. Paul, Minn.—Bids will be received until June 22 by the Bd. Pub. Wks. (R. L. Gorman, Clk.) for constructing sewers in portions of Isabel St. and Lincoln Ave.

Corinth, Miss.—Kirkpatrick & Johnson, of Jackson, are making plans for a system of about 7 miles of house sewers.

St. Charles, Mo.—Carr Edwards, City Engr., writes that the City Council will receive bids July 1 for a complete set of plans for a sanitary system of sewers. H. C. Dallmeyer, Chmn. Com.

Butte, Mont.—Press reports state that bids will be received until June 21 by the City Clk., for constructing sewers in Woodman St. and Idaho Alley.

Trenton, N. J.—Bids will be received until June 20 by the Common Council for constructing sewers in portions of W. State and Chambers Sts. and Nitz Alley. Harry B. Salter, City Clk.

**Atlantic City, N. J.*—The contract for building inlet drains in Atlantic Ave. is stated to have been awarded to the McGovern Constr. Co., of Trenton, for $3,143.

Newark, N. J.—Bids are wanted June 22 for constructing 28,000 ft. of 8 to 24-in. pipe sewers and 5,000 ft. of brick or concrete sewers, as advertised in The Engineering Record.

Beverly, N. J.—The question of constructing a sewerage system is reported to be under consideration here.

**Camden, N. J.*—Aaron Ward, of Camden, has secured the contract for constructing the Chestnut St. sewer at the following bid: 4½-ft. sewer, $4.51 per lin. ft.; 4-ft. sewer, $4.17; 3½-ft. sewer, 9-in. walls, $3.40; 2½-ft. sewer, 4-in. walls, $1.37; all 10-ft. sand cut. Also to same contractor for one mile of small sewers, 16x24 in., with 4-in. walls, 77 cts. to 91 cts. per lin. ft.; all 7-ft. sand cut.

Brooklyn, N. Y.—Bids will be received until June 28 by Martin W. Littleton, Boro. Pres., for furnishing materials and constructing sewers in portions of E. 22d St., Rogers and Church Aves. Engineer's estimate: 1,820 lin. ft. 15 and 12-in. sewer; 784 lin. ft. 54-in. reinforced concrete sewer; 177 cu. yds. concrete cradle; 33 manholes, etc.

Bids will be received until June 28 by Martin W. Littleton, Boro. Pres., for furnishing materials and constructing sewers in portions of numerous streets. Engineer's estimate: 8,540 lin. ft. 102, 96, 78, 54, 48, 42, 36 and 30-in. reinformed concrete sewer; 6,441 lin. ft. 24, 18, 15 and 12-in. pipe sewer; 508 manholes; 597,000 ft. B. M. foundation planking and pile capping; 1,100,000 ft. B. M. sheeting and bracing; 10,000 lin. ft. piles; 14,700 ft. B. M. foundation planking; 2,920 cu. yds. concrete cradle under pipe sewers, etc.

Long Island City, L. I., N. Y.—Bids will be received until June 26 by Jos. Cassidy, Pres. Boro. Queens, for constructing sewers and appurtenances in portions of 1st and 9th Aves. Engineer's estimate: 2,593 lin. ft. 12 and 15-in. vitr. salt-glazed or cement concrete sewer pipe; 2,550 lin. ft. 6-in. salt-glazed or cement concrete sewer pipe as risers for house connections; 19 manholes, etc.

Arverne, L. I., N. Y.—The Arverne-by-the-Sea Assoc. is reported to have decided to petition the Greater New York City officials to improve and enlarge the trunk sewer and disposal works.

Freeport, L. I., N. Y.—The South Shore Sanitary Co., of Freeport, has been incorporated to construct, equip, improve and develop sewerage and disposal works, and sewage and drainage systems and plants; capital, $50,000. Directors: Chas. C. Moore and Zophar Smith, of Freeport, and Eugene Gilroy, of New York.

Utica, N. Y.—Bids are wanted July 21 for the construction of an intercepting sewer about 5,000 ft. long, to be constructed of concrete, brick or stone, as advertised in The Engineering Record.

White Plains, N. Y.—The Bronx Valley Sewer Comn. was organized on June 14 with Wm. Archer, of Mt. Vernon, Chmn.; Frank N. Glover, of Mt. Vernon, Secy., and Geo. R. Byrne, of White Plains, Engr. They will have charge of the expenditure of $2,000,000 for the construction of a sewer from White Plains to Yonkers, to empty into Hudson River.

Binghamton, N. Y.—Bids will be received until June 27 by D. C. Herrick, City Clk., for constructing a sewer in New, Vine and Duane Sts. and Curran Ave. Approximate estimate of the quantities required: 7,000 cu. yd. ex., 150 cu. yd. concrete, 30 cu. yd. masonry laid in cement, 505,460 brick in work; 300 lin. ft. 28-in., 105 ft. 8-in. and 1,200 ft. 6-in. pipe and 50 lin. ft. 15-in. iron pipe. The sewer is 2,892 ft. long, consists of 40 in. by 60 in. egg-shaped brick, 30 in. by 45 in. oval brick and 28½ in. by 42¾ in. oval brick.

Scotia, N. Y.—Bids will be received until June 22 by the Village Trus. for furnishing material and laying sewers, manholes, etc. L. B. Sebring, C. E., Rm. 47, Parker Bldg., Schenectady; Jas. A. Hoyt, Jr., Village Clk.

Wahpeton, N. D.—See "Schools."

Cincinnati, O.—Bids will be received July 5 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for improving portions of Stanley St. and Babb Alley, by constructing sewers.

*The following are the bids opened June 9 for constructing sewers in Colerain Ave. (bidders of Cincinnati unless otherwise mentioned): Wm. Flynn, $14,791; J. Ruebel Bros., $12,018 (awarded contract); Doylers P. & Co., $13,792; J. E. Mahoney, $13,755; T. P. Strack, $14,470; G. P. Walker, $13,730; Keeling, Ridge & Co., Cleveland, O., $14,405, and J. B. Washburn, Cincinnati, O., $12062.

Bids will be received until June 23 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and improving portions of Linden and Vaughn Sts. by constructing sewers and drains.

Bowling Green, O.—The estimated cost of reconstructing the Poe and tributary sewers and the construction of a catch basin to take the place of a sewage disposal plant is reported to be about $24,000.

Hamilton, O.—Press reports state that bids will be received July 1 for $7,000 sanitary sewer bonds. Thad. Straub, City Aud.

Akron, O.—The lowest bid opened on June 2 by the Bd. of Pub. Service for the construction of a storm sewer along South and Brook Sts. is stated to have been submitted by McAlonan Bros. for $5,494.

Portland, Ore.—Chas. Wanzer, City Engr., writes that the proposed Irvington sewer will be constructed of brick and stone, and cost about $150,000.

Gettysburg, Pa.—Bids are wanted July 3 for constructing a complete sewerage system, involving about 9 miles of pipe, as advertised in The Engineering Record.

**Darlington, S. C.*—Ebaugh & Ebaugh, of Greensville, are reported to have secured the contract for constructing about 20 miles of sewers in Darlington (bids opened June 1).

Chattanooga, Tenn.—Bids will be received until June 24 by Alex. W. Chamblis, Mayor, for $350,000 bonds; $275,000 for school, park, street and sewer, and $75,000 for Highland Park improvement.

Waco, Tex.—It is stated that bids will be received by Jas. B. Baker, Mayor, until June 22, for furnishing materials and constructing a 5-ft. brick storm sewer on 18th St. Address R. B. Dickey, City Secy.

Ft. Walla Walla, Wash.—Bids will be received June 23 by Capt. Noble H. Creager, Q. M., U. S. A., for furnishing materials and installing a 6-in sewer in the new barracks at this place.

Seattle, Wash.—Bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., June 24, for sewers in 2d Ave. W. and other streets, to cost about $36,400; also for concrete walks on Boston St., to cost $15,200.

Ordinances have been passed for the improvement of Connecticut and other streets by grading and paving with vitr. brick, at an estimated cost of $16,400; also for a sewer in Westlake Ave.; cost, $11,000.

**Aberdeen, Wash.*—The contract for constructing sewers in Dist. A is stated to have been awarded to F. A. Keasal, of Tacoma, for $23,944. The sewers for Dist. K1 are stated to have been abandoned for the present.

South Milwaukee, Wis.—Bids are wanted until June 29 for furnishing materials and constructing a section of sewer in a portion of Marquette Ave. Jos. Saxler, City Clk.

Sheridan, Wyo.—The citizens are reported to have voted June 2 to issue $38,000 bonds, for a sanitary sewerage system.

Toronto, Ont.—Bids will probably be received about Aug. 1 for the installation of a system of septic tanks and bacteria beds at foot of Woodbine Ave.; probable cost of work, $80,000. C. H. Rust, City Engr.

BRIDGES.

Notes Arranged Alphabetically by States.

Lyme, Conn.—It is reported that the plans for the new bridge for the New York, New Haven & Hartford R. R. Co. (Colin M. Ingersoll, Ch. Engr., New Haven, Conn.) over the Connecticut River, at Lyme, have been approved at Washington, and it is expected that the new structure will be completed within a year. The plans call for 7 fixed truss spans and a draw 145 ft. long over the channel.

**Washington, D. C.*—The contract for constructing the Anacostia Bridge is stated to have been awarded to the Penn Bridge Co., of Beaver Falls, Pa., for $325,500.

Chicago, Ill.—Plans are stated to have been approved for the construction of a bridge at Archer Ave., replacing the present structure recently condemned.

It is stated that about $758,000 has been appropriated by the Erie R. R. Co. (Francis Lee Stuart, Ch. Engr., New York, N. Y.) for rebuilding bridges and culverts along the route, including the construction of a bridge over the tracks at the Chicago yard, at a cost of $150,000; also $266,000 for constructing 45 bridges and culverts on the Susquehanna Division.

Bids will be received until June 21 by the South Park Comrs. (E. G. Shumway, Secy.) for constructing 4 concrete bridges for Sherman Park.

Aurora, Ill.—This city has in contemplation the construction of new bridges to replace old structures across Fox River at Stolps Island; width 60 ft.; length 170 ft. each. Plans will be prepared at once. Myron J. Tarble, City Engr.

Hartford City, Ind.—It is reported that bids are wanted until June 20 for constructing 3 steel bridges, 5 concrete and 3 stone abutments; C. E. Lancaster, Co. Aud.

Emrichsville, Ind.—Bids will be received until June 27 by the Bd. Co. Comrs. (John M. Gregor, Chmn.) at Indianapolis, for constructing a bridge over White River at this place.

**Lafayette, Ind.*—G. H. Stevenson, Co. Surv., writes that the Lafayette Eng. Co., of Lafayette, has secured the contract for constructing a 125-ft. span steel bridge with concrete floor over North Fork Wild Cat Creek (bids opened June 7) for $4,070.

Terre Haute, Ind.—It is reported that bids will be received until July 8 by the Bd. Co. Comrs. for constructing the Dildine, Wyeth, Howard, Mackeye and Schimerer bridges in Riley Township and the Tom Moore bridge in Linton Township.

Natchitoches, La.—The R. R. bridge at Grand Ecore, it is stated, is in an unsafe condition and will probably have to be rebuilt by the Louisville & Nashville Ry. (W. H. Courtenay, Ch. Engr., Louisville, Ky.).

Portland, Me.—Bids, plans and specifications will be received on July 8 for constructing a bridge across Fore River, to be 1,348 ft. long, 40 ft. wide, and to have two sidewalks, as advertised in The Engineering Record.

Baltimore, Md.—See "Electric Railways."

**Baltimore, Md.*—The Steel Concrete Constr. Co., Albany, N. Y., it is stated, has received the contract to construct a 34-ft. concrete bridge for the United Rys. & Electric Co., across Gwynn's Falls, at Frederick Ave.

North Adams, Mass.—Bids will be received until June 21 by the Comr. Pub. Wks. for constructing the steel superstructure of a plate-girder highway bridge at North Adams; also separate bids for moving, altering and erecting the steel superstructure of a plate-girder bridge now being used for highway purposes and street car traffic at North Adams, as advertised in The Engineering Record.

Alpena, Mich.—The Massillon Bridge Co., of Massillon, O., is stated to have submitted the lowest bid for constructing a cement bridge over Thunder Bay River.

Wahasha, Minn.—Bids will be received by the Co. Comrs. until July 11 for constructing a steel bridge, said bridge to have a 90-ft. span and two 181ft. approaches, main bridge on tubular piers and approaches on steel piling; strength, 1,600 lb., and roadway, 16 ft. Fred F. Bade, Co. Aud.

**Items marked thus give the names of parties awarded contracts.*

St. Paul, Minn.—The construction of a bridge into the reservation at Ft. Snelling is reported under consideration.

Duluth, Minn.—The Bd. of Pub. Wks., it is stated, has been authorized to receive bids for constructing a permanent bridge across the Jenswold St. subway, the cost to be about $6,000.

Hattiesburg, Miss.—The Co. Bd. of Superv., it is stated, has ordered the construction of 2 steel bridges across Leaf River, 1 at Wingate and the other at Beaumont.

**Fulton, Miss.*—The Nashville Bridge & Constr. Co., of Nashville, Tenn., it is stated, has received the contract to construct a steel bridge across Tombigbee River, on the Fulton and Tupelo Road, at $5,343.

Clarksdale, Miss.—The Bd. of Superv., it is reported, has decided to appropriate $100,000 for the building of roads and bridges throughout the county.

Lincoln, Neb.—The building of a viaduct at J St. is reported under consideration.

Jersey City, N. J.—Bids will be received by the Bd. of Chosen Freeholders on June 19 for building a new centre pier, a draw span, new resting piers and painting fixed spans of Newark Ave. Bridge over Hackensack River, as advertised in The Engineering Record.

Binghamton, N. Y.—A. H. Sutermeister, Consulting Engr. of the State R. R. Comn., it is stated, has been engaged to prepare plans and specifications for the iron bridge which is to be constructed over Chamberlin Creek, at Robinson St.

It is stated that plans have been prepared for a bridge having a capacity of 4 tracks, which is to be constructed across the Chenango River by the Erie R. R. (Francis Lee Stuart, Ch. Engr., New York, N. Y.).

**Dayton, O.*—F. M. Turner, City Engr., writes that the contract for constructing a concrete steel bridge over Great Miami River at Washington St. (bids opened June 6) has been awarde dto Frank J. Cullen, of Chicago, Ill., for $116,810. For list of bids received for this work, see issue of The Engineering Record June 10.

Columbus, O.—Bids will be received by the Bd. Co. Comrs. until June 22 for furnishing materials, reflooring, paving, sand-blast cleaning and painting the superstructure of Frank Road Bridge, over Scioto River; L. E. Jones, Co. Aud.

It is reported that the City Council and the Co. Comrs. are considering the rebuilding of the Clifton Ave. bridge.

Akron, O.—The City Council has approved plans for a bridge to be built by the B. & O. R. R. (D. D. Carothers, Ch. Engr., Baltimore, Md.) across E. North St.

**Cleveland, O.*—It is stated that the contract to construct a concrete steel bridge across the Newburg and South Shore road, near Central Furnace, has been secured by Williams Bros. & Morse, Builders' Exchange, at about $17,000.

The following are the bids opened by the Bd. of Pub. Service, June 12, for a timber trestle on South Willson Ave., Burke Brook Valley: Williams Bros. & Morse, $8,180; J. F. Meyer, $7,866; L. Garrett, $8,115; Reaugh Constr. Co., $10,613, and W. J. Gawne & Co., $10,035. The lowest bidder, J. F. Meyer, bid for 48 lin. ft. piles, $9 per cu. ft.; 165.5 M. ft. lumber, to be treated with Avenarius carbolineum, $39.75 per M. ft., and 5,600 lbs. Bolts, etc., 5 cts. per lb.

It is stated that bids will be received until June 24 by the Co. Comrs. for constructing concrete steel culverts and masonry abutments. Julius C. Dorn, Co. Clk.

Fossil, Ore.—It is stated that bids will be received by the Co. Comrs. until July 5 for constructing a bridge across John Day River having a 160-ft. span. H. F. C. Heidtmann, Co. Surv.

Reading, Pa.—Bids will be received until June 23 by Horace F. Livingood, Co. Compt., for constructing a bridge across Saucony Creek in Maxatawny Township, known as Deturk's Bridge. Bids will be received on a steel-girder superstructure with a concrete roadway; also for a truss superstructure with concrete roadway and masonry work.

Meadville, Pa.—It is reported that the Co. Comrs. contemplate constructing several bridges throughout the county and will have plans prepared by W. T. Dutton, Co. Surv. The bridges to be constructed include the following: In Summerhill Township, 2 low-truss steel bridges, 50x16 ft.; in South Shenango, 1 steel tram bridge, 30x16 ft.; Sparta Township, 1 steel tram bridge, 42x16 ft.; 1 new low-truss steel bridge, 75x16 ft., on the line of Venango and Cambridge Townships; to rebuild in Richmond Township a low-truss steel bridge, 64x14 ft., to replace the old Bidwell wooden bridge; in Rockdale Township, to put in a low-truss steel bridge to replace the old wooden bridge at Hoag's mill.

Pittsburg, Pa.—Attorneys Robt. Ritchie and David Cooper, of Beaver, and W. S. Thomas, of Pittsburg, it is reported, are about to incorporate the Hopewell & Harmony Bridge Co., for the purpose of constructing a steel bridge across the Ohio River at Legionville station, about 25 miles below Pittsburg.

Berwick, Pa.—The following are the bids opened June 13 by the Bd. Pub. Grounds & Bldgs., Harrisburg (J. M. Shumaker, Supt.) for rebuilding the substructure and superstructure of bridge over Susquehanna, bet. Berwick and Nescopec: Lane Bridge Co., $265,000; C. H. Reimard, $222,981; W. H. Stebbins, $218,000; Peter Keefer, $227,000; Eyre Constr. Co., $221,950; Horn & Neff, $219,000; Penn Bridge Co., $216,867; York Bridge Co., $209,500; Alleger & Co., $220,000; King Bridge Co., $236,258; Champion Bridge Co., $280,776; Variety Iron Wks., $268,000; Oswego Bridge Co., $221,600; Groton Bridge Co., $222,000; Canton Bridge Co., $224,200; Nelson & Buchanan Co., $273,000; Berlin Constr. Co., $244,900; T. H. Prior & Sons, $245,000; Jacob Weidelich, $227,500; Old Dominion Bridge & Constr. Co., $270,000; Brackett Bridge Co., $275,000; John P. Cowing, $285,500; Belmont Iron Wks., $257,800; Whalen Constr. Co., $230,000; Ellory & Colby, $214,000; P. E. Lane, $229,000; Riverside Bridge Co., $248,960, and Penna. Steel Co., $229,890.

Providence, R. I.—The City Council is stated to have passed a resolution authorizing the issue of $125,000 bonds for rebuilding a portion of Point St. Bridge.

**Chattanooga, Tenn.*—B. H. Hardaway, of Columbus, Ga., it is stated, has received the contract for the 6 piers for the drawbridge which is to be constructed across the Tennessee River for the Southern Ry. Co. The contract is reported to amount to about $100,000.

**McQueeny, Tex.*—The contract for constructing a bridge over Guadalupe River is stated to have been awarded to E. P. Alsbury & Son at $13,400. The structure is to be a steel bridge having a 250-ft. suspension span.

Norfolk, Va.—See "Railroads."

Superior, Wis.—The construction of a bridge, 80 ft. steel span, across Nemadji River, at 18th St., is reported under consideration.

Roblin, Ont.—It is stated that bids will be received until June 20 by Reeve Gill for constructing a Howe truss bridge over the Assiniboine about 10 miles from this place.

Thamesford, Ont.—It is stated that bids will be received until June 26 by B. D. McCarty for constructing a concrete arch, 50-ft. span, in East Missouri Township.

Brookholm, Ont.—It is stated that bids will be received until June 23 by Wm. Pedwell Reeve for constructing a steel bridge, 80-ft. span c. to c., 16-ft. roadway.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Helena, Ark.—Bids will be received until July 1 by the paving com. of the Cherry St. property owners and the Bd. Pub. Affairs (R. E. Chew, Jr., Chmn.) for the construction of about 7,948 sq. yd. brick pavement on a concrete foundation and for the excavation of about 2,500 cu. yd. of compact material.

**Denver, Colo.*—The Colorado Co., Nassau Bldg., it is stated, has received the contract for grading in S. Bway., Dist. No. 2, at $73,312, and J. Fred. Roberts the contract for sidewalks at $42,705.

Trinidad, Colo.—Bids are wanted July 1 for paving Main and Commercial Sts. (Paving Dist. No. 1) with vitrified brick, as advertised in The Engineering Record.

Washington, D. C.—Bids will be received until June 20 at the Bureau Supplies and Accounts, Navy Dept., for constructing a macadam road within the grounds of the Naval Hospital, Washington.

Tampa, Fla.—Street improvement bonds amounting to $300,000, it is reported, have been sold.

Belleville, Ill.—Bids will be received by the Bd. o1 Local Improv. June 24 for paving Illinois St. with vitrified brick. L. L. Harper, City Engr.

East St. Louis, Ill.—See "Sewerage and Sewage Disposal.

Oregon, Ill.—It is reported that the City Council has appropriated $22,000 for street improvements.

Bloomington, Ill.—The City Council on June 9 passed ordinances providing for the pavement of Seminary Ave. with brick and for a pipe sewer on Center St.

La Salle, Ill.—It is proposed to lay about 100,000 sq. yds. of pavement. C. M. Rickard, City Engr.

Chicago, Ill.—An ordinance has been passed by the Council providing for the grading and paving with granite blocks on Western Ave., from Ogden to Blue Island Aves., at a cost of $120,000.

Sterling, Ill.—The paving of W. 3d St., from Ave. G to west limits of the city, is reported under consideration. The material used will probably be brick.

**Bloomfield, Ind.*—W. H. Deckard, Co. Aud., writes that the contract for constructing a gravel road in Spafford Township (bids opened June 10) has been awarded to Musselman & Slinkard, of Newberry and Lyons, Ind.

Vincennes, Ind.—Bids will be received by the Bd. Co. Comrs., until July 7, for constructing 3,710 ft. of road, known as the Jas. I. Kelso et al system of free gravel roads in Vincennes Township; John I. Scott, Co. Aud.

Greencastle, Ind.—Bids will be received July 3 by the Bd. Co. Comrs. (Cam. H. Judy, Chmn.) for improving 8,325 ft. macadamized road in Bussell Township; also same date for 11,415 ft .in Madison and Washington Townships; C. C. Hurst, Co. Aud.

Indianapolis, Ind.—Bids will be received until June 21 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for grading, curbing and paving with brick portions of East St. and Roosevelt Ave., and grading, graveling and rolling the roadway on a portion of Roache St.; also for grading and paving with cement the sidewalks on portions of Sheffield and Roache Ayes.

The Bd. Pub. Wks. has decided to pave with bituminous macadam on Downey Ave., from Washington St. to Ritter Ave.

The building of a Boule. on St. Clair St., from Massachusetts Ave. to the Technical Inst. grounds, is reported under consideration.

Hartford City, Ind.—Wm. Harley, City Engr., writes that the following are the bids opened June 1 for paving Jefferson St. with vitrified brick on a 5-in. Portland cement concrete foundation, with combined curb and gutter, cement sidewalks, 6 ft. wide, 12-in. vitr. pipe sewer, 9 manholes and 40 catch basins, etc. Figures were submitted on different classes of brick. Bridges & Sons, on Metropolitan block only, $24,162; Mohlering & Co. submitted 9 bids for different classes of brick, $24,502 to $25,269. John Hays & Son (4 bids), $27,536 to $28,303. Hines & Bolan (9 bids), $28,873 to $29,809; Nolan & Slattery (7 bids), $24,335 to $25,187; Aylsworth & Cox (5 bids), $27,590 to $28,649. Hatch & Sons (11 bids), $23,948 to $24,758. Michaels & Minnick (7 bids), $24,318 to $25,229. Fred Hoffman (4 bids), $24,745 to $24,915. Gubbins & Co. (14 bids), $28,733 to $28,818. Neal Paving Co. (6 bids), $27,256 to $28,108. Union Asphalt Co. (4 bids), $29,775 to $30,626. Waugh & Buchanan (3 bids), $25,895 to $26,319. J. P. Knight (4 bids), $23,583 to $23,923. Carter, Mackey & Co. (8 bids), $30,033 to $30,969. W. N. Vaughn (4 bids), $25,987 to $26,413, and the Western Constr. Co. (3 bids), $25,371 to $25,882.

The bid of Nolan & Slattery will probably be accepted for paving Main St. with brick, about 6,720 sq. yds. (bids opened June 8). They bid for Metropolitan block, $15,033; Hocking Valley block, $14,966, and Poston block, $15,033.

**Brazil, Ind.*—The contract for paving with brick on E. Main, Walnut and Franklin Sts. is stated to have been awarded to Michael & Minnick, of Marion, at $1.32 and $1.33 per sq. yd.

Bedford, Ind.—Bonds amounting to $34,790 are reported sold for constructing gravel roads in Lawrence County.

**Waterloo, Ia.*—M. Ford, of Cedar Rapids, Ia., it is stated, has received the contract to pave with Purington repressed vitrified brick block on 3 east side streets at $1.92 per sq. yd., and for paving the Melan arch bridge at $1.98 per sq. yd.

Des Moines, Ia.—The City Council has approved the plans for the paving with asphalt on W. Walnut St., 10-in. each side of the street railway tracks to be of brick.

It is reported that J. W. Budd, City Engr., has completed plans for paving with asphalt on portions of W. Walnut St.

Louisville, Ky.—The General Council has approved the ordinance for the improvement of Floyd St., from H St. to the Southern Ry. crossing, and it is stated that bids will soon be asked by the Bd. Pub. Wks. for paving same with vitrified brick blocks.

The Fiscal Court, it is stated, has passed a resolution to lay one-half mile of steel road on the Bardstown Pike for heavy loads, the cost to be about $7,000.

*Mayor Grainger, it is stated, has approved the awarding of a contract to the Barber Asphalt paving Co., 347 5th St., for the paving with asphalt on a portion of Frankfort St., the total cost to be about $40,000.

Local press reports state that the Bd. Pub. Wks. will receive bids about June 24 for paving with asphalt on a portion of Preston, Kentucky and Walnut Sts. and 4th Ave. several alleys with brick, and also for reconstructing Main St., from Johnson to Stone Sts., with vitrified brick, the cost of this street to be about $14,000.

The Bd. of Pub. Wks., according to local press reports, will soon ask bids for paving with brick on sidewalks on portions of several streets, with granitoid on sidewalks on Lee and Green Sts., and for paving with vitrified brick on Cane Run road and 3 blocks on Floyd St.

Newport, Ky.—The City Council has passed a resolution to pave several streets with brick, including many of the leading thoroughfares of the city.

New Orleans, La.—The following are reported to be the bids received June 4 by the Finance Com. for repairing asphalt streets on which the maintenance guarantee has expired: Louisiana Improv. Co. $220,000 for the first year and $30,000 each for the 2d and 3d years, and the Barber Asphalt Paving Co., $114,500 for the first year and $40,000 each for the 2d and 3d years.

Bids were opened, according to reports, at the same time for paving a portion of Lapeyrouse and Dorgenois Sts. The Barber Asphalt Paving Co. bidding $2.06 per sq. yd. on both streets, and the Louisiana Improv. Co. $2.10 5-6 per sq. yd. on both streets, and the Sicilian Co. $2.10 5-6 per sq. yd. on Dorgenois St.

The Bd. of Control of the New Basin Canal and Shellroad, it is stated, has decided to pave the head of the New Basin from the edge of the water line to the outer street curb, and from Julia St. to Howard Ave. with either Belgian block or vitrified brick, in all a distance of about 1,182 sq. yd.

**Frederick, Md.*—Geo. Edw. Smith, Mayor, writes that the contract for laying about 5,587 sq. yds. vitr. fireclay block, etc. (bids opened June 12) has been awarded to Coryell Constr. Co., of Williamsport, Pa., for about $15,000.

Baltimore, Md.—The repaving of Fremont Ave., from Columbia to Lafayette Aves, and appropriating $85,000 for the purpose, is reported to be under consideration.

**Ft. Strong, Mass.*—J. J. Sullivan, of Boston, has secured the contract for paving at this post (bids opened June 14 by Maj. John E. Baxter, Constr. Q. M., U. S. A., Boston, for $1,565.

Worcester Mass.—It is stated that Main St. will be paved with bituminous macadam.

The joint standing Com. on Finance on June 3, it is stated, appropriated $50,000 for the repaving of Southbridge St., from Franklin Sq. to Madison St., and Park St., from Main to Salem Sts.

It is stated that Main St. is to be paved with bitulithic macadam, from Hawthorne to Hammond Sts.

**Traverse City, Mich.*—W. R. Caldwell, City Engr., writes that the Central Bitulithic Paving Co., of Detroit, has secured the contract for 11,000 sq. yds. paving at $2.11 per sq. yd. and 5,500 ft. combined curb and gutter at 45 cts. per ft. (bids opened June 2). John Scanlon bid on brick $1.75 and combined curb and gutter 50 cts. Cleveland Trinidid Co. bid for asphalt $1.85 and combined curb and gutter 50 cts. The Barber Asphalt Paving Co. bid for sheet asphalt $1.80, for bituminous macadam $1.85, and combined curb and gutter 49

Manistee, Mich.—E. W. Muenscher, Engr. Bd. County Road Comrs., has completed location of 2¼ miles of Onckamee Branch Road, through a very difficult section of the county. In 1¼ miles it rises 367 ft. above Lake Michigan. The contract for the grading will be let immediately. About 27,000 cu. yds. of material are to be removed. This will make about 29 miles of road constructed in this county under the County Road Law.

Saginaw, Mich.—The following are the bids opened June 8 by the Bd. of Pub. Wks. for paving portions of Carroll, Baum, 5th and Hancock Sts. (*a*) 5,490 sq. yds. asphalt; (*b*) 3,385 sq. yds. brick (price given per sq. yd.): Capital Asphalt Pav. Co., *a* $1.48, *b* $1.60; Cleveland Trinidad Pav. Co., *a* $1.57, *b* $1.65; Barber Asphalt Co. (4 bids), solid asphalt, *a* $1.57, *b* $1.59; Genasco asphalt, *a* $1.67; Trinidad Land asphalt, *a* $1.69, and Trinidad Lake asphalt *a* $1.79; Z. & J. Lalonde, Saginaw, *b* $1.44; John C. Davies, Saginaw, *a* $1.74, *b* $1.54; Patrick Crowley, Saginaw, *b* $1; Eddy & Leaman *b* $1.52.

**Grand Rapids, Mich.*—The contract for improving Emerald Ave. is stated to have been awarded to Jas. McDermott & Sons for $5,075.

*Jas. McDermott & Son, it is stated, have secured the contract to pave a portion of Island St., at $10,320.

The City Engr. estimates the cost of paving on a portion of E. Bridge St. with Medina stone at $3,750, and with brick on concrete at $2,800.

Bay City, Mich.—The City Engr. is stated to have estimated the cost of paving Woodside Ave. at $32,607.

Minneapolis Minn.—The City Council has voted to pave Washington Ave. S. with sandstone block, 12th St. S. and Clinton Ave. with creosoted block.

**St. Paul, Minn.*—W. J. Prendergast, it is stated, has received the contract to macadamize Rice St., a distance of about 2½ miles, at $7,965. Others bids received for this work were: P. J. Ryan, $10,180; J. M. Thornton, $8,425, and J. Forrestal & Co., $8,827.

**Items marked thus give the names of parties awarded contracts.*

The Bd. Pub. Wks. is considering the macadamizing of E. 7th St., from Phalen Ave. to White Bear Ave., at an estimated cost of $24,750.

Flemington, N. J.—It is reported that the Co. Comrs. rejected all the bids received June 7 for constructing 5½ miles of road between Ringoes and Lambertville. The bids received were as follows: J. B. Salmon, Hackettstown, $49,474; John H. Hurley, Trenton, $50,814; McGovern Constr. Co., Trenton, $49,646; Delaware River Quarry & Constr. Co., $47,900.

West Hoboken, N. J.—Bids will be received until June 21 by the Town Council for paving Lake St. with Belgian block; probable cost, $9,000. Sebastian Maulbeck, Town Surv.

Mt. Holly, N. J.—Bids will be received by the Bd. of Chosen Freeholders of Burlington County, on July 5, for building a stone road in the Township of Lumberton, known as Newbolds Corner and Eayrestown Road; also same date for building a gravel road in the Townships of Southampton and Tabernacle, known as Red Lion and Tabernacle Road; also on July 11 for building a Telford stone road in the Townships of Cinnaminson and Delrane, known as Westfield and Camden Turnpike, all three proposals advertised in The Engineering Record.

Union Hill, N. J.—The Council is said to be considering the paving of Pleasant Ave. in connection with the Bulls Ferry Road improvements, contemplated in the town of Weehawken.

Weehawken, N. J.—It is stated that bids are soon to be asked for $70,000 bonds, issued for the purpose of paving Bulls Ferry Road.

Jersey City, N. J.—The Barber Asphalt Paving Co., New York, N. Y., it is stated, submitted the lowest bid for paving with asphalt on Newark Ave., from Warren to Brunswick Sts., at $2.46 per sq. yd.

The repaving of Newark Ave., from Cook St. to Palisade Ave., and Central Ave., from Hoboken Ave. to Congress St., is reported under consideration.

New York, N. Y.—Bids will be received until June 29 by the Park Bd. (John J. Pallas, Pres.) for furnishing and delivering asphalt paving blocks.

New York, N. Y.—Bids will be received until June 29 by the Park Bd. (John J. Pallas, Pres.) for repairing the walk pavements of City Hall Park, Boro. Manhattan.

Long Island City, L. I., N. Y.—Contracts for street paving in the Boro. of Queens, bids for which were opened by Jos. Cassidy, Boro. Pres., June 12, it is stated, have been awarded as follows: To the U. S. Wood Preserving Co., 29 Bway, N. Y. City, for wood block on Broadway, Flushing, $56,034; Sanford Ave., Flushing, $45,322; Jamaica Ave., Flushing, $13,007; 2d Ave., College Point, $34,615; Lefferts Ave., Richmond Hill, Town of Jamaica, $22,322. To Bart Dunn, 444 E. 68th St., N. Y. City, grading, curbing, laying sidewalks and crosswalks on Debevoise Ave., a distance 1½ miles, for $48,640, and same work, Hulst St., from Thomson to Greenpoint Ave., about ½ mile, at $9,900, both in Long Is. City. To Barber Asphalt Paving Co., 114 Liberty St., N. Y. City, paving with asphalt, Carver St., $8,664, and 9th Ave., from Jamaica Ave. to Bway, with concrete curb, at $8,145; also Webster Ave., $7,518. To Peace Bros., Jackson Ave., grading, curbing, bridging and laying sidewalks, 7th Ave., $4,890, and Hallett St., $3,636; also same work on 3d Ave., $8,360; 16th Ave., $6,330, and N. Henry St., $3,105. To T. H. Burden, 449 Ditmas Ave., grading, curbing and laying sidewalks, Academy St., $11,380. Thos. A. Brown, grading, curbing and laying sidewalks on Vanderventer Ave., $4,530, and same work, Crescent Ave., $7,882. To Queensboro Constr. Co., same work, Prospect St., $5,604. To John Horne, same work on Webster Ave., $16,240. To the Interstate Asphalt Paving Co., for paving wth asphalt 9th Ave., from Grand Ave. to Jamaica Ave., $7,371, and for asphalt block paving in Grandview Ave., Ridgewood, $17,041. To The Long Is. Constr. & Supply Co., for grading, curbing and sidewalks on Hulst St., from Foster to Skillman Aves., $3,554.

Bids will be received until June 26 by Jos. Cassidy, Pres. Boro. Queens, for regulating, grading, curbing and laying sidewalks on portions of Albert St., 5th and 9th Aves. Engineer's estimate: 44,400 sq. ft. cement sidewalk; 9,080 lin. ft. concrete curb, etc.; also same date for furnishing and delivering to the Bureau Highways broken stone and screenings in the 3d Ward, Boro. Queens.

New Brighton, S. I., N. Y.—Bids will be received until June 27 by Geo. Cromwell, Boro. Pres., for furnishing materials and regulating, grading and paving portions of several streets. Engineer's estimate: 18,350 sq. yd. macadam pav't, 5,000 sq. yd. vitr. brick pav't, 1,500 lin. ft. 4-in. underdrain, 6,450 cu. yd. excav., etc. Boro. Richmond. Clinton & Russell, Archts., 32 Nassau St., New York City.

**Cortland, N. Y.*—The Bd. of Pub. Wks. is stated to have awarded to E. J. Conroy, of Oneida, the contract for paving with brick Pendleton St., for $7,540.

Albany, N. Y.—The Bd. of Contract and Supply is stated to have opened on June 5 the following bids for paving with granite block about 2,080 sq. yds. on Liberty St. (price given per sq. yd.): Mulderry Bros., $2.23; M. F. Dollard, $2.28; Albany Material & Constr. Co., $2.30; John Doyle, $2.23; Cameron & Hawn Realty Co., $2.45; Jos. T. Sheehan, $2.40; E. F. Dillon, $2.50, and R. Morgan & Co., $2.70.

Oneida, N. Y.—C. M. Ruggles, City Clk., writes that it was voted June 9 to issue $12,000 bonds for paving portions of William and Sconondon Sts., and $4,000 for paving Chestnut and West Sts.

Ft. Totten, Willets Point, N. Y.—Bids are wanted June 23 for grading, macadam roads, and cement sidewalks at Ft. Totten, as advertised in The Engineering Record.

**Binghamton, N. Y.*—D. C. Herrick, City Clk., writes that A. D. Osborn, of Binghamton, has secured the contract for paving Court St. with brick, at $1,81 per sq. yd.

Rochester, N. Y.—Brayer & Slbaugh, 27 Main St., E., it is stated, submitted the lowest bid for paving with Metropolitan brick on a portion of Hudson Ave., at $65,355.

*The Bd. of Contract, it is stated, awarded the contract to pave with Jamestown brick on a portion of Hartford St. to Whitmore, Rauber & Vicinus, 279 South Ave., at $11,306, and the contract to pave with the same material on a portion of Linwood Place to F. A. Brotsch & Son, 826 Clinton Ave., S., at $2,537.

Wellsville, N. Y.—Bids are wanted June 26 for paving 4 streets with brick, about 3,600 sq. yds. paving and 7,000 lin ft. curb, as advertised in The Engineering

Newburgh, N. Y.—City Engr. Garrison estimates the cost of paving Lander St., from Bway to South St., at $27,500.

Buffalo, N. Y.—The paving of Tonawanda St. with brick at a cost of $35,000 is being considered by the Bd. of Aldermen.

Newark, N. Y.—Bids will be received until June 26 by the Bd. Village Trus. for paving with Metropolitan block, Corning brick or blocks or brick of equal quality, about 1,840 sq. yd. paving, 600 cu. yd. excav., 1,270 lin. ft. stone curb, 1,270 lin. ft. 3-in. drain tile and 52 lin. ft. protection curb. O. W. Harris, Village Clk.

Wadesboro, N. C.—It is stated that surveys have been made for the improvement of Depot St., at a probable cost of $10,000.

Lorain, O.—The Sheffield Land Co. is reported interested in the building of a macadam and slag wagon road between South Lorain and Elyria, to be about 4½ miles long and between 30 and 40 ft. wide.

Elyria, O.—Press reports state that bids are wanted until July 3 for $14,500 bonds for paving a portion of East Ave. Frank R. Fauver, City Aud.

**Cincinnati, O.*—The Bd. of Pub. Service, it is stated, has awarded the contract to pave with bitulithic on Pike St., from 3d to 5th Sts., to Henkel & Sullivan, Bodmann Bldg., at $2.83 per sq. yd.; total, $7,798, and to the Barber Asphalt Paving Co., Traction Bldg., the contract to pave with asphalt on Poplar St., from Linn to Baymiller, at $1.58 per sq. yd.; total, $4,122, and to repair E. 5th St., from Vine to Walnut Sts., at $1.06 per sq. yd.; total, $2,408.

Bids will be received until July 5 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and paving a portion of 5th St., by grading, curbing and paving with asphalt.

**Findlay, O.*—The contract to pave with Bolen block on a portion of Franklin Ave., it is stated, has been awarded to C. B. Hall & Son at $4,680.

Chester, Pa.—It is reported that the Councils have rejected bids received June 5 for paving on a portion of 6th St., and will readvertise.

Shamokin, Pa.—The Council has passed ordinances authorizing the paving of Walnut and Cleaver Sts., and the widening of the pavement on 3d St.; also passed on first reading the ordinance authorizing the paving of 2d St.

New Castle, Pa.—The Street Com. has recommended to the Council the widening of W. Washington St., at a cost of about $10,000.

Harrisburg, Pa.—The Select Council is reported to have passed the ordinance providing for the paving of portions of Reily and 4th Sts.

Pottstown, Pa.—Bids are wanted June 27 for paving King St. with vitr. brick on a stone and sand foundation, 12,000 sq. yds., as advertised in The Engineering Record.

Emleton, Pa.—Bids are wanted July 5 for about 9,275 sq. yds. of brick or asphalt block paving on Main St., as advertised in The Engineering Record.

Bellevue, Pa.—Bids will be received until June 20 by J. M. Simeral, Clk. Council, 69 Harrison Ave., for improving portions of Forest and Bryant Aves., by grading, curbing and paving, requiring 6,088 sq. yds. paving; 8,930 lin. ft. stone curb; 750 ft. 15-in. sewer, etc. John McBride, Boro. Engr., Rm. 46, Fidelity Bldg., Pittsburg.

**Wilkesbarre, Pa.*—The State Highway Dept., it is reported, has awarded the contract to rebuild 8 miles of Harvey's Lake road in Luzerne County to Geo. B. Stucker. The cost reported to be about $50,000.

Steelton, Pa.—It is stated that specifications are being prepared by Mason D. Pratt, of Steelton, for the paving of Front St., either with wood blocks, brick or sheet asphaltum.

Providence, R. I.—John H. Edwards, Chmn. State Bd. Pub. Roads, writes that all bids received June 7 for about 5,280 ft. of road for Warwick and 2,640 ft. in Portsmouth have been rejected.

*Contracts for other portions of state roads, bids opened same time and place as above, have been awarded as follows: To J. Overton Peckham, for 7,140 ft. in Middletown and Tiverton; to Amos D. Bridge, for 5,280 ft. in Narragansett, and to the Lewis J. Peirce Bldg. Co. for 10,560 ft. in East Providence and Barrington.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Dallas, Tex.—The paving of Ross Ave. with brick at an estimated cost of $90,000 is reported under consideration.

It is stated that the paving of about 1 mile on S. Lamar St. with Jacksboro rock, at a cost of about $20,000, is underconsideration.

Ft. Worth, Tex.—It is proposed to lay about 1,500 sq. yds. vitr. brick pavement on a 5-in. concrete foundation. John B. Hawley, City Engr.

Seattle, Wash.—See "Sewerage and Sewage Disposal."

**Spokane, Wash.*—Peter Costello, 118 Mission Ave., E., it is stated, has secured the contract to grade, curb and lay sidewalk on Sharp Ave. at $2,140; regrade, curb and lay sidewalk on Cannon St., at $2,900, and on 9th Ave. at $2,840. Jas. C. Broad, 106 Post St., secured the contract to regrade, curb and sidewalk 6th Ave. at $3,731.

Beloit, Wis.—Bids will be received by the Bd. of Pub. Wks. on July 8 for paving 4th St. with vitrified block, 2,612 ft. Robt. Caldwell, City Engr.

Madison, Wis.—The City Council is said to be considering the macadamizing of the streets around the capitol square.

**Superior, Wis.*—Berg & Olson, 1019 Ogden Ave., it is stated, have received the contract to macadamize Hammond Ave. at $14,944, and C. H. Bird, the contract to macadamize W. 4th St., at $8,249.

Milwaukee, Wis.—It is stated that the Bd. of Pub. Wks. intends paving with standstone on Clybourn St., from 2d to 6th Sts. and Galena St., from 3d to 4th Sts.

**Toronto, Ont.*—The Barber Asphalt Paving Co., it is stated, has secured the contract to pave with asphalt on a portion of Markham St. at $8,050, and J. H. McKnight, the contract to pave on Woodbine to east city limits at $13,573.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Blanche, Ala.—S. W. Henderson, of Durango, Colo., writes that there is a movement on foot to construct a power plant at Blanche, but nothing definite has yet been done.

San Francisco, Cal.—It is reported that bids will be received until July 1 by the Bay Co. Power Co. (Fred'k W. Zeile, Pres., 464 California St.) for $22,500 bonds.

Long Beach, Cal.—The United Improvement Co. is reported incorporated to operate a gas plant at Long Beach; capital, $1,000,000. Directors: H. S. Farnsworth, W. G. Blair, F. F. Briggs and others, all probably residents of Los Angeles. The company is also reported to be considering the construction of a gas plant at Ocean Park.

Sebastopol, Cal.—Wm. T. Searles, Town Clk., writes that the Sebastopol Light, Power & Water Co. has secured the franchise for the electric light and power plant (bids opened June 6).

Washington, D. C.—Bids will be received until June 27 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, etc., Portsmouth, N. H.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C.; Annapolis, Md., and Indian Head, Md., a quantity of naval supplies, as follows: Generators; electrical supplies; rheostats; motors; incandescent lamps; building and broken stone; brick; asphalt; Portland cement; pipe and fittings; hydraulic jacks; forges; drill press; pipe cutting machines; steam engines; steam gauges, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

*The contract for furnishing to the District about 900 incandescent mantel gas lamps for street lighting during the fiscal year 1906 is stated to have been awarded to the Cleveland Lighting Co., of Cleveland, O., at $20.50 per lamp per year.

Pensacola, Fla.—Bids will be received until July 15 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing a brick and steel power house at the Navy Yard, Pensacola; also same date for a 150-ft. radial brick chimney for Bldg. No. 47 central power house, at said navy yard.

Menlo, Ga.—A. J. Lawrence, of Chelsea, Ga., writes that the proposed power plant to be constructed near Menlo will cost $150,000.

Bushnell, Ill.—The City Council has granted a 10-yr. extension of franchise to the Bushnell Electric Light & Power Co. (C. A. Duntley, Mgr.), with provision that certain additional equipment be added to the present plant within 90 days after July 1. Two 175-h.p. boilers, two 175-h.p. engines and generators and auxiliary equipment will be purchased by the company at once.

Montpelier, Ind.—The Montpelier Light & Water Co. has been incorporated with a capital of $75,000. Directors: T. J. Driscoll, P. C. Connors and others.

Valley Junction, Ia.—The Valley Junction Water & Light Co. is reported incorporated with a capital of $12,000. John Fisher is one of the incorporators.

Waukon, Ia.—It is reported that the Electric Light Co. proposes to construct a concrete dam 200 ft. long and 20 ft. high.

Winfield, Ia.—Press reports state that John Baxter and Edw. Huston are on the committee which is investigating the matter of rebuilding the gas plant which was recently burned.

Frontenac, Kan.—The Crawford County Light & Water Co. (Jos. Fletcher, Mgr., Frontenac) is reported to have secured a franchise for an electric light plant. H. G. Whiteleather, City Clk.

Grayson, Ky.—Claude Wilson, of Olive Hill, is reported to have secured a franchise for an electric light plant and telephone system; total cost of work reported to be about $25,000.

Elkton, Md.—The Co. Comrs. are stated to have granted permission to Wm. T. Harburton, Pres. Elkton Electric Light Co., to erect a pole line from Gilpin Falls, at Bay View to Elkton via Pleasant Hill.

Winona, Minn.—The Winona Gas Co. is preparing plans for a 200,000 cu. ft. holder, which with changes to machinery and other additions, will cost about $40,000.

St. Charles, Mo.—The St. Charles Lighting Co. is reported incorporated with a capital of $150,000, by Jos. McCollum, Lloyd Shepard, of East St. Louis, Ill., and others.

Lincoln, Neb.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., July 11 for installation of a conduit and electric wiring system for U. S. Court House and Post Office at Lincoln, as advertised in The Engineering Record.

Ft. Crook, Neb.—Bids will be received June 20 by Maj. M. Gray Zalinski, Constr. Q. M., U. S. A., Omaha, for an electric lighting system at Ft. Crook.

Deal, N. J.—The Elberon Water, Power & Light Co., of Elberon, is stated to have secured a franchise to lay mains and conduits for lighting and other purposes in Deal.

Camden, N. J.—The Pleasantville Electric Light Co. is reported incorporated with a capital of $125,000 by Chas. E. Machold, Augustus H. Riddell and Howard F. Morgan, all of Camden. Principal office to be at Camden.

Trenton, N. J.—The Northumberland County Ry. & Light Co. has been incorporated at Trenton, N. J., with a capital of $1,000,000, to supply gas and electric light for cities and to construct outside of New Jersey railroads for the transportation of passengers and freight. Incorporators: Wilbur F. Sadler, Jr., Trenton, N. J., and Wm. W. Hepburn and Geo. Parkman, both of Philadelphia, Pa.

Jersey City, N. J.—The Sioux City Service Co., of Jersey City, is reported incorporated with a capital of $250,000, to manufacture, generate and supply electricity for light, heat, etc. Incorporators: Louis B. Dailey, Thos. F. Barrett and B. Stafford Mantz, all of Jersey City.

**Items marked thus give the names of parties awarded contracts.*

New York, N. Y.—Bids will be received until June 26 by C. B. J. Snyder, Supt. School Bldgs., for installing electric equipment in School 38, Boro. Manhattan.

Buffalo, N. Y.—Bids will be received by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for installing, furnishing and delivering power to drive an electrically-driven centrifugal pump at the pumping station, Bureau of Water, for 1, 3 or 5 years, beginning about Dec. 1, 1905.

Niagara Falls, N. Y.—The Niagara Falls Hydraulic Power & Mfg. Co. is reported to have decided to erect a new power house and improve the canal.

Tonawanda, N. Y.—The Council is reported to have granted franchises to the Niagara Falls Electrical Transmission Co. and the Niagara, Lockport & Ontario Power Co. Both companies must maintain their stations within Tonawanda.

New Rochelle, N. Y.—The Empire State Gas & Electric Light Co. has been incorporated, with a capital of $50,000, to operate in Westchester County. Directors: Wm. H. Cooper and N. Raymond Fox, of New Rochelle, and Chas. J. Van Slyke, of N. Y. City.

Schenevus, N. Y.—The Albany, Susquehanna Valley & Binghamton Power Co., of Schenevus, has been incorporated with a capital of $75,000. Directors: M. E. Baldwin and John Graney, of Schenevus, and Geo. Brooks, of Cooperstown.

Lockport, N. Y.—The Niagara, Lockport & Ontario Power Co. (Robt. E. Drake, Attorney, Syracuse) has filed with the clerk of the counties of Erie, Monroe, Orleans, Seneca, Wayne, Ontario, Cayuaga and Onondaga certificates of extension of business in these counties.

Geo. Schaff, of Buffalo, is stated to have secured the contract for constructing a power house for the Niagara, Lockport & Ontario Power Co. on Niagara River, for about $25,000. No contracts are reported to have been let as yet for the power house at Lockport.

Otsego, N. Y.—The Otsego Transmission Co. has been incorporated; capital, $40,000. Incorporators: Wm. W. Capron and Wm. H. Smith, of Oneonta, and others.

Watertown, N. Y.—The Jefferson County Gas & Electric Co. has been incorporated; capital, $100,000. Incorporators: John B. Taylor, Fred. B. Pitcher and B. J. McCarthy, all of Watertown.

Castleton, N. Y.—The Castleton Light, Heat & Power Co. has been incorporated; capital, $25,000. Incorporators: Joel D. Smith, Thos. E. Clifford and Frank H. McKnight, of Castleton.

Troy, N. Y.—The Bd. of Contract and Supply is reported to be considering the question of establishing a municipal electric light plant to be used for lighting Monument Square and city buildings in that locality.

King's Mountain, N. C.—J. C. Patrick, City Clk., writes that bids are wanted July 15 for constructing an electric light plant, to cost about $15,000.

Morehead City, N. C.—The City Clk. writes that bids will probably be received in July for the construction of water works and an electric light plant.

Lewisburg, Pa.—Philadelphia capitalists are reported to have purchased the gas works and the electric light plant at Lewisburg and propose remodeling and installing new machinery at the gas plant.

Steelton, Pa.—The Dauphin County Consolidated Gas Co. is stated to have purchased the plant of the Steelton Home Gas Co., and will construct a pipe line from Steelton to Oberlin, Erhaut and Highspire. A new gas reservoir will be constructed at Steelton, with a capacity of 100,000 cu. ft. It is also proposed to build gas tanks at both Middletown and Highspire of about 50,000 cu. ft. capacity each.

**Philadelphia, Pa.*—The Reading Ry. Co. is stated to have awarded to Enos L. Seeds, of Philadelphia, the contract for constructing a power house at Port Richmond. The power plant will be used for the operation and lighting of the shops there.

York, Pa.—The Baltimore & Susquehanna Canal Power Co., of Baltimore, Md., and the York Furnace Power Co., owned by Geo. B. Wilson and associates of Lancaster, are stated to have been consolidated and, it is reported, that the proposed power plant on the lower Susquehanna River in York County will probably be constructed this summer.

**Greenville, S. C.*—J. F. Grandy & Sons are stated to have secured the contract for constructing the dam for the Salunda River Power Co. (A. G. Furman, of Greenville, Pres.) Orders for machinery and electrical apparatus are also reported to have been let.

Conway, S. C.—A charter has been granted to the Conway Light & Power Co., with a capital of $10,000. D. A. Spivay, Pres.

Elkton, S. D.—O. W. Marshall, Town Clk., writes that bids are wanted June 26 for the construction of a gas plant; probable cost, $6,000.

Yankton, S. D.—Sanford Donaldson is reported to have secured a franchise for an electric light plant.

Nashville, Tenn.—The Southern Electric Co. is stated to have increased its capital from $20,000 to $40,000, and will enlarge its plant. O. C. Turner, Gen. Mgr.

Gainesville, Tex.—J. A. Jones and E. E. Hull are reported to have purchased the plant of the Gainesville Light & Fuel Co., and will expend from $15,000 to $25,000 in rebuilding the plant and extending the main. W. C. Penfield, Mgr.

Dallas, Tex.—The Mayor has approved the ordinance passed by Council, granting a franchise to the Dallas Gas & Fuel Co.

Del Rio, Tex.—John M. Gray, of the Del Rio Electric Light & Ice Co., writes that the plant has already been installed, but it is proposed to increase the capacity later on.

Rossland, B. C.—Press reports state that the West Kootenay Power & Light Co. (L. A. Campbell, Gen. Mgr. & Ch. Engr., Rossland) proposes expending about $1,000,000 in improvements. The intention is to build a pole line via Dewdney trail to Cascade and to Grand Forks and Greenwood, a distance of about 83 miles.

Mexico City, Mex.—The Mexican Light & Power Co. is reported to have purchased all the light and power plants in this city. It is reported that the total expenditures of this company when its work is complete will be about $40,000,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Jacksonville, Fla.—The Jacksonville Suburban & Seashore R. R. Co. has been organized to construct an electric railway from this city to or near Pablo Beach; capital $300,000. John D. Lawrence, Pres.; William A. Riddle, Secy.

Bluffton, Ind.—Bids will be received on June 24 by the Marion, Bluffton & Eastern Traction Co. (R. F. Cummins, Secy.) at Bluffton, for grade and fence work for a line between Marion and Bluffton, as advertised in The Engineering Record. Engineer, F. F. Van Tuyl.

Portland, Ind.—The City Council has granted a franchise to the Ft. Wayne & Springfield Traction Co., and the line will be extended from Decatur to Portland.

Columbus, Ind.—The Columbus St. Ry. & Light Co. is stated to have decided to construct a new power house on Sycamore St. With the new power house will be combined a central steam-heating plant.

Lafayette, Ind.—The Ft. Wayne & Wabash Valley Traction Co. is stated to have decided to extend its Lafayette line to Battle Ground this summer, a distance of 4 miles. The next link will be an extension between Battle Ground and Logansport.

Mt. Ayr, Ia.—Wallace Hubbard, Vice-Pres. and right-of-way agent for the St. Joseph, Albany & Des Moines Electric Ry. Co., is reported to have been in this city recently, concluding work of arranging for condemnation proceedings for a right of way of this proposed line through Iowa. The work of securing the right of way for this line from Des Moines to the Missouri State line is practically complete.

Baltimore, Md.—Bids will be received until July 7 by The Roberts & Abbott Co., No. 1123 Scofield Bldg., Cleveland, O., for grading and pipe culverts for the Washington, Baltimore & Annapolis El. Ry.; approximately 730,000 cu. yd. grading and 1,600 ft. pipe culverts, various sizes, in place.

Trenton, N. J.—The Trenton St. Ry. Co. is considering a plan to extend its Interstate Fair Ground line or the East Trenton line from the present terminal to the new Pennsylvania Railroad shops.

Auburn, N. Y.—The Auburn & Northern Electric R. R. Co. has filed with the Secretary of State a certificate of extension of route in Auburn.

Cincinnati, O.—The Cincinnati, Toledo & Detroit Short Line Ry. Co. contemplates constructing a road. J. Morgan, of Toledo, is reported interested.

The Cincinnati, Milford & Loveland Traction Co. is stated to have decided to increase its bonded debt by an issue of $275,000, which will be issued for the extension of the road to Blanchester.

**Cleveland, O.*—The Standard Engineering Co., of Cleveland, is stated to have secured the contract for extending the line of the Columbus, New Albany & Johnstown Traction Co., of Columbus, from Gahanna to Johnstown, a distance of 17 miles.

The Cleveland, Ashland & Mansfield Traction Co. will shortly be incorporated with a capital of $1,000,000, to build an extension of the Cleveland & Southwestern from Chippewa Lake to Ashland and Mansfield.

The Roberts & Abbott Co., Scofield Bldg., has been retained as consulting engineer for the Toledo & Jackson Ry. The line will be 70 miles long, connecting Jackson, Battle Creek, Kalamazoo and other towns with Toledo.

Defiance, O.—The Defiance, Wauseon, Adrian, Ann Arbor & Detroit Traction Co. is reported incorporated to build a line between above mentioned points. Incorporators; W. W. Campbell, C. E. Bennett, J. H. Miller, and others.

Toledo, O.—It is stated that the Toledo Ry. & Light Co. has under consideration the extending of its Bancroft St. line to connect with the new line to Ottawa Park.

It is reported that the Toledo & Chicago Interurban Ry. Co. will construct an electric railway. The line is to extend west from the terminus of the Toledo & Western at Pioneer. F. B. Perkins, of Toledo, Ch. Engr.

The Patrick Hirsch Constr. Co., which is financing the Toledo, Ann Arbor & Detroit Traction Co., is stated to have awarded a contract for construction work to the Fidelity Constr. Co., of Detroit. The section from Toledo to Ann Arbor, 43 miles in length, will be constructed at first.

The Toledo, Port Clinton & Lakeside Ry. Co. will, it is stated, as soon as the new line is completed to Lakeside, which will be about July 15, construct a line from Genoa to Toledo, paralleling the Lake Shore Electric Ry.

Akron, O.—The Westinghouse Electric & Mfg. Co. is reported to be preparing plans and specications for the equipment of the Cleveland, Akron & Southern Fast Line.

St. Clairsville, O.—J. Harmony, of Canton; F. M. Cowen, of Flushing, and E. L. McMillen and C. L. Weems, of St. Clairsville, are reported interested in the construction of a line from St. Clairsville to Urichsville.

Youngstown, O.—The promoters of the Lake Erie, Mahoning & Southern Ry. Co. are stated to have closed a contract for 4,000 acres of coal lands near Canfield. The contract calls for the building of a line into Youngstown within one year.

Coshocton, O.—The Muskingum, Coshocton & Tuscarawas Traction Co., recently formed to build from Zanesville to New Philadelphia, will equip its line to handle coal as well as passengers and freight.

Mansfield, O.—Chas. L. Jackson, representing Philadelphia capitalists, is reported to have inspected the route of the proposed Wooster & Mansfield Ry. David Collier, of Mansfield, is a promoter of the road.

Wadsworth, O.—Property owners between Wadsworth and Barberton, on the line of the proposed Barberton, Wadsworth & Western Ry., are reported to have donated right of way and have agreed to subscribe for stock.

Galion, O.—W. L. Ball, promoter of the Galion Southern Ry., is reported to have announced that the bonds of his company have been floated and right of way all secured. It is stated that construction work will start at once. The road will run from Galion to Mt. Vernon.

Hamilton, O.—The City Council has granted a 25-year franchise for 20 miles of extensions to be made to the city lines of Cincinnati Northern Traction Co. in this city. It is reported that the company will spend $1,000,000 in Hamilton, including $500,000 for a power station, $350,000 on tracks and road construction, $150,000 in rolling stock. Another million will be expended on the main line between Dayton and Cincinnati.

Steubenville, O.—The Wheeling Traction Co., of Wheeling, W. Va., is stated to have applied to the Co. Comrs. for franchises to extend its line to Portland Station, Dillonville and Connorville.

Wauseon, O.—The Westinghouse Electric & Mfg. Co. is reported to be preparing estimates for the construction of the line of the Ohio Northern Traction Co., from Defiance to Wauseon. Eventually the road will be extended to Napoleon and on to Adrian, Mich.

Springfield, O.—E. D. Evans, of the Motor Electric Vehicle Co., Detroit, Mich., is reported to be organizing two companies here, each with $50,000 capital, to enter new territory undeveloped by traction lines. One route will be from Springfield through Clinton, Cedarville and Jamestown, and the other from Springfield through Catawba, Mechanicsburg, Milford Center and Marysville.

Frank Patterson, promoter of the Springfield, Charleston, Washington C. H. & Chillicothe Traction Co., which has been in the hands of a receiver for some time, has completed arrangements for financing the proposition and will go ahead with the extension of the road as originally contemplated.

Philadelphia, Pa.—Plans have been filed for an extension to the brick power house of the Philadelphia Rapid Transit Co. at Wyoming Ave. and 3d St., at a cost of $20,000.

New Castle, Pa.—The Western Pennsylvania Motor Power Co. is reported formed to build electric lines in Mercer, Lawrence and Butler Counties; capital $10,000.

Walla Walla, Wash.—Isaac W. Anderson, Pres. of the Northwestern Gas & Electric Co., is stated to have been authorized by the directors of the Walla Walla Traction Co., just organized, to close contracts for rails, ties and equipment, and also to employ engineers to survey a route.

Cheyenne, Wyo.—Judge John Porter, of Des Moines, Ia., is reported interested in the plan to construct an electric railway in Cheyenne. It is stated that he will invest $50,000 if local business men will subscribe to $50,000 of the stock of a stock company to be formed. If suitable power cannot be obtained from the Warren Electric Light Co. here, Mr. Porter will construct an independent power house. The line will traverse the principal streets of the city and extend to Ft. Russell.

Windsor, Ont.—The Ry. Com. of Dominion Parliament is stated to have given permission to the Windsor, Essex & Lake Shore Rapid Ry. Co. to extend its lines from Essex to Tilbury.

Niagara Falls, Ont.—The Niagara, Dunville & Erie Electric Ry. Co. is stated to have been authorized to build a line from St. Catherines to Dunville and Port Dover, and to establish a rural telephone service.

Ottawa, Ont.—The Ottawa River Ry. has received permission from the Dominion Parliament to build two branch lines; one from Orilla to Port Stanley, and the other from the Township of Mera to Toronto.

Perth, Ont.—The Perth & Huron Electric Ry. Co. is stated to have asked for incorporation by the Dominion Parliament. The company will operate from Stratford to Grand Bend, and from Stratford to Tavistock.

Whitby, Ont.—An agreement is reported to have been reached between the Municipal Councils of the townships of Pickering and West Whitby and the village of Pickering and the Toronto & York Radial Ry. Co., by which the early extension to Whitby of the Scarboro line of the Toronto radial system is assured.

RAILROADS.

Notes Arranged Alphabetically by States.

Florence, Ala.—Jos. R. Neblett, of Charlotte, Tenn., is reported to be making a preliminary survey for the proposed Tennessee Industrial R. R., to run from Florence, Ala., to the mouth of Harper River, via Charlotte, crossing the Nashville, Chattanooga & St. Louis R. R. at Pond. The road will be built in the near future.

Malvern, Ark.—The Saline Bayou R. R. Co. has been incorporated, with a capital of $30,000, by Louis Warner, of St. Louis; Dougald McMillan, of Arkadelphia, and others, to construct a railroad 14 miles in length, from Oakleaf, on the Iron Mountain road in Hot Springs County, through Hot Spring, Clark and Dallas Counties, to or near Joan.

Lester, Ark.—A charter has been granted to the Lester & Ouachita Valley R. R. Co., with a capital stock of $102,500, to construct a railroad 24 miles in length, from Lester to Rosston. Incorporators: F. R. Pierce, of St. Louis, Mo.; A. P. Green, of Lester, Ark.; L. S. Parkman, of Camden, and others.

Sparta, Ga.—Application was made to Secy. of State for a charter for the East & West R. R., to be operated from Sparta to Sandersville.

Chicago, Ill.—See "Bridges."

South Bend, Ind.—The South Bend & Western Ry. Co. has been incorporated; capital, $100,000. Directors: Wm. L. Taylor, Wm. W. Babcock, Mortimer P. Reed and others.

Louisville, Ky.—T. C. H. Vance, of the Highland Land Co., is stated to have decided to take up the abandoned plans of the Louisville, Cincinnati & Dayton R. R. Co., and construct a line from Jeffersonville to Cincinnati. It is proposed to use the old surveys and rights of way of the former company. The new company will be capitalized at $3,000,000, the cost of the road being estimated at $2,250,000.

Baltimore, Md.—The Baltimore Terminal Co. is stated to have asked permission from the City Council to construct and maintain what is intended to be the Baltimore end of the Washington, Baltimore & Annapolis Ry. It is proposed to build a double-track route. Geo. T. Bishop, of Cleveland, O., is president of the company. Terminal rights are reported to have been secured in Washington and Annapolis.

Clinton, Mass.—Engr. F. W. Bateman, of Clinton, writes that the town has petitioned for the appointment of a commission to consider the abolition of grade crossings.

**Items marked thus give the names of parties awarded contracts.*

Detroit, Mich.—See "Miscellaneous."

South St. Paul, Minn.—The South St. Paul Union Stock Yards Co. is reported to have voted to expend $138,000 in improvements and extensions during the coming year. Of this amount $72,000 will be devoted to improvements and extensions of the stock yards proper and $66,000 to the extension of railway trackage.

Rodeo, N. M.—The Arizona Central R. R. Co. is reported incorporated, with a capital of $1,250,000, to construct a railroad from Rodeo, N. M., to Paradise, Ariz., and to Bowie. Incorporators: A. H. McKay, Santa Barbara, Cal.; B. F. Graham and L. C. Hanks, of Douglas, Ariz., and others.

New York, N. Y.—The American Committee interested in the construction of a tunnel under Behring Strait has appointed a board of consulting engineers, consisting of Alfred Craven, Edw. Bond, Elmer L. Corthell, Dr. John A. L. Waddell and J. L. Harrington, and has authorized Mr. Waddell to begin surveys immediately. The work includes a 38-mile tunnel, a rail route through Siberia, 3,800 miles in length, to a connection with the Trans-Siberian road at Irkutsk, and on the Alaskan end the route will pass Council City, Nulato and Fairbanks to a point about 100 miles south of Dawson, where it will connect with the Grand Trunk Pacific, as its route to Dawson has been projected. The mileage in Alaska will be about 1,200, making a total of 5,000 miles between terminal points.

Fountaindale, Pa.—Surveyors are reported to be at work between Emmitsburg and Fountaindale, in Adams County, running the lines for the new Wabash R. R. (W. S. Hewhall, Ch. Engr., St. Louis, Mo.), to tidewater, which will lead by tunnel through the mountains.

Manila, P. I.—The War Dept. is reported to have announced that bids for the construction of railways in the Philippine Islands, under the act of Congress passed in February for that purpose, will be received in Washington, D. C., and in Manila Nov. 1. Bids will be received only from individual citizens or copartnerships of the United States or of the Philippine Islands or from railroad corporations organized and existing under the laws of a State or the United States or the Philippines. The construction will, it is stated, approximate about 1,000 miles.

**Armour, S. D.*—The Milwaukee R. R. Co. is stated to have awarded to McIntosh Bros., of Milwaukee, Wis., the contract to build 35 miles of new railroad from Armour to Plankinton.

El Paso, Tex.—It is stated that 400 miles of road, from El Paso to Durango, will be built this year by Phelps, Dodge & Co., who have just acquired the New Mexico Ry. & Coal Co. The El Paso & Durango R. R. Co., with a capital of $8,000,000, is reported organized and work on the new line will begin as soon as the surveys are completed. At Durango the new line will connect with the Denver & Rio Grande R. R.

**Salt Lake City, Utah.*—Press reports state that Hammond & Jeffrey, of St. Louis, Mo., and Kansas City, Mo., have secured the contract to build the Western Pacific Ry., which is a part of the great Gould Western line, completing the connection with the Gould lines, the Denver & Rio Grande to the Pacific. The total distance is 711 miles, to be completed in two years. The Western Pacific will run from Salt Lake Junction to San Francisco, completing another transcontinental line.

Norfolk, Va.—The Bd. of Harbor Comrs. is stated to have granted the Tidewater Ry. Co. permission to build 2 bridges over the eastern and southern branches of Elizabeth River, and also to construct 3 piers 700 ft. long and 175 ft. wide on the west side of the southern branch of the Elizabeth River.

Golden, B. C.—The Canadian Pacific Ry. Co. (W. F. Tye, Ch. Engr., Montreal, Que.) is reported to have decided to build this summer a line from Golden, B. C., to Ft. Steele, near the line of the Crow's Nest Pass Ry. The branch will be known as the Kootenay Central Ry.

Tampico, Mex.—The St. Louis, Brownsville & Mexico R. R. Co. is reported to have decided to extend its line to Tampico. A bridge to cost about $250,000 will be constructed across the Rio Grande River. Jeff. N. Miller, of Kingsville, Tex., will probably have charge of the work.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—It is reported that the Bd. of Health has accepted the plans submitted by John C. Austin, Douglas Bldg., for the detention hospital, which is to be erected at an estimated cost of $50,000.

Waterbury, Conn.—The House has passed a bill authorizing this city to issue $50,000 city hall bonds.

Hartford, Conn.—The Senate has passed a bill appropriating $15,000 for the erection of the Hartford Hospital tuberculosis annex.

Washington, D. C.—Bids will be received until June 26 by the Comrs., D. C., (Henry B. F. McFarland, Chmn.) for constructing a police court building at 6th and D Sts. N. W.

Washington Barracks, D. C.—It is reported that all bids received May 22 for erecting 6 buildings at this post for use of non-commissioned officers' quarters have been rejected, and the material for the buildings will be purchased by Capt. John Stephen Sewell, Corps. Engrs., U. S. A., Washington Barracks, and the work done by day labor.

Wallace, Idaho.—Press reports state that bids will be received until July 10 by the Co. Comrs. for erecting the new Co. Court House.

Harlem, Ill.—The Village Bd. has appropriated $25,000 for the erection of a village hall.

**Ft. Sheridan, Ill.*—The contract to erect the hospital here, it is stated, has been awarded to Jas. Corse, of Racine, Wis., at $25,000. It is to be 2 stories high, of brick and stone, 100x50 ft.

Chicago, Ill.—Bids will be received Aug. 9 by the Bd. Trus., Sanitary Dist. of Chicago (S. D. Griffin, Clk., 1110 Security Bldg.), for making alterations to the Seipp Bldg., located on the south side of Van Buren St., and for constructing a concrete dock along said Seipp property.

It is reported that bids are wanted until June 21 for erecting additions to park buildings in Sherman and Bessemer Parks, including plumbing, roofing, electric wiring and lighting fixtures. D. H. Burnham & Co., Archts., Railway Exchange Bldg.

Alexander Levy, 112 Clark St., is preparing plans for the remodeling of the Jewish school at 592 N. Wood St. into a home for the Max Nathan orphanage. An addition to the present structure will also be built. The cost is estimated at $25,000.

La Salle, Ill.—V. A. Matteson, of La Salle, has prepared plans for a Carnegie Library, to cost $20,000.

**Edwardsville, Ill.*—J. F. Rees, of Bloomington, it is reported, has received the contract to erect the Carnegie Library, at $11,350.

Ida Grove, Ia.—It is reported that bids are wanted until June 30 for erecting a City Hall, fire station and jail. Frank W. Griffith, Archt., Ft. Dodge, Ia. W. J. Scott, City Clk.

Burlington, Ia.—It is stated that the Co. Comrs. have authorized G. H. Washburn, 53 Parsons Blk., to prepare plans for the new county building which is to replace the stone building at the county farm, which was recently destroyed by fire.

Louisville, Ky.—Bids will be received until June 23 by T. H. Baker, Custodian, for installing 4 new steam boilers and accessories in the Post Office and Court House here.

New Orleans, La.—Bids will be received until July 22 by Sim Weis, Chmn. Touro Infirmary & Hebrew Benevolent Assoc., care of Favrot & Livaudais, Ltd., Archts., 839 Gravier St., for furnishing material and erecting a 3-story fireproof brick hospital for the Assoc.

**Plaquemine, La.*—The following are reported to be the bids received June 10 by the Com. on the New Court House: N. A. Dawson, Houston, Tex., $40,890; W. O. Burton & Co., New Orleans, $46,000; C. D. Stewart, Baton Rouge, $43,000; Thos. Lovell Contr. Co., Denison, Tex., $45,900; F. D. Hull, Jackson, Miss., $44,900; John Arthur, Shreveport, $39,500 (awarded contract); General Supply & Contr. Co., New York, $50,400; A. L. Patterson & Co., New Orleans, $46,300.

**Baltimore, Md.*—Harry Rogers, Mayor's Secy., writes that Wm. Ferguson & Bro., 214 Clay St., have secured the contract for reconstructing the St. Paul St. side of the court house and for cleaning the other 3 sides for $127,051.

Worcester, Mass.—The Joint Standing Com. on Finance, it is stated, has appropriated $15,000 for the erection of a workshop for the Pub. Bldgs. Dept. at E. Worcester and Shrewsbury Sts.

Worcester, Mass.—The erection of an engine house at School and Commercial Sts., at a cost of $96,000, is reported under consideration.

Amesbury, Mass.—The following are the bids opened June 8 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction, complete, of U. S. Post Office at Amesbury: Wheaton Bldg. Co., Putnam, Conn., $44,000; P. H. Jackson, Boston, $44,355; Morris H. Maney, Boston, $48,725; M. A. McCormick, Newport, R. I., $56,820; Fissel & Wagner, New York, N. Y., $42,445, and Richardson & Burgess, Washington D. C., $42,437.

**Brockton, Mass.*—Wm. Lays, 80 Railroad Ave., has secured the contract for erecting an armory for $30,000.

**Winona, Minn.*—J. Winczewski, Co. Aud., writes that the contract for erecting a county poor building (bids opened May 17) has been awarded to Seidlitz & Werner, of Winona, for $18,000.

Stillwater, Minn.—The State Bd. of Control at St. Paul, it is stated, is considering plans for the building of a new prison here for which $75,000 has been appropriated, $40,000 being available this year.

Wilmar, Minn.—It is stated that bids will be received until June 21 by T. O. Gilbert, Wilmar, for erecting a Lutheran Orphans' Home near Wilmar. Thori, Alban & Fisher, Archts., St. Paul, Minn.

Kirksville, Mo.—The Comrs. of Adair County have been authorized by a vote of the taxpayers to issue $17,000 bonds to erect a jail and sheriff's residence.

Reno, Nev.—The only bid received on June 7 by the Superv. Archt., Treas. Dept., Washington, D. C., for construction, complete, of U. S. Post Office at Reno, was submitted by W. H. Maxwell, of Pierre, S. D., for $48,665.

**Franklin, N. H.*—John H. Smith, of Littleton, it is stated, has secured the contract to erect the library at about $20,000.

Overbrook, N. J.—The Bd. of Chosen Freeholders at Newark, it is stated, has authorized Hurd & Sutton, 763 Broad St., Newark, to prepare plans for the entire group of buildings which it is proposed erecting at Overbrook for the County Hospital for the Insane. The cost to be about $1,000,000.

New York, N. Y.—Bids will be received until June 23 by the Bd. Health (Thos. Darlington, M. D., Pres.) for furnishing materials to complete alterations at the Willard Parker Hospital, foot E. 16th St., Boro. Manhattan.

Brooklyn, N. Y.—Bids will be received until June 29 by the Park Bd. (John J. Pallas, Pres., New York City) for erecting a shelter in Cooper Park, Boro. Brooklyn; also Forest Park, Boro. Queens.

Saratoga Springs, N. Y.—Additions and improvements are to be made to the State Armory of Company L on Lake St., the cost to be about $40,000.

New Brighton, S. I., N. Y.—Bids will be received until June 27 by Geo. Cromwell, Boro. Pres., for furnishing materials for carpenter, structural steel and iron, heating and electric installation work required for erecting sheds, smithy, storerooms, etc., in connection with Stable No. 1, Bureau Street Cleaning; also Stable No. 2, Boro. Richmond.

Batavia, N. Y.—The Women's Hospital Assoc., it is stated, is considering the erection of an addition to the hospital; $20,000 was recently left to this hospital, $10,000 of which was to be used toward the construction of an addition.

**Binghamton N. Y.*—The Co. Bd. of Supery., it is stated, has awarded the contract for installing the heating plant in the armory to Gaylord & Eitapenc, 153 State St., at $6,973.

**Newburgh, N. Y.*—Archt. Fred M. Sneed, 52 2d St., writes that the Pauly Jail Bldg. Co., 11223 Bway, New York, has secured the contract for the jail work for $18000, and J. D. Wilson, of Newburgh, the contract for the mason and carpenter work (bids opened June 12). Bids will be received shortly for the plumbing and steam heating.

Cleveland, O.—The Bldg. Com. appointed to have charge of the erection of the Museum of Art in Wade Park, toward which the Huntington estate gave $50,000, consists of the following: L. E. Holden (Chmn.), Henry C. Ranney, Judge Wm. B. Sanders, C. W. Bingham, J. H. Wade and H. A. Kelley. C. W. Fuller has been appointed secretary of the Com. The total cost of the building is to be about $2,000,000. No archt. selected as yet.

It is reported that J. Milton Dyer, Cuyahoga Bldg., has notified the City Hall Comn. that plans for the new city hall will be ready about June 21.

Fargo, N. D.—Bids will be received until July 24 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for constructing complete (except elevator) the U. S. Post-office and Court House extension at Fargo.

National Military Home, O.—Bids will be received until July 5 by A. J. Clark, Treas., for furnishing materials and erecting nurses' quarters at the home; Peters, Burns & Pretzinger, Archts., Dayton.

Portland, Ore.—Bids will be received June 30 by Maj. W. C. Langfitt, Corps Engrs., U. S. A., Portland, for erecting the Mukilteo Point light station, Wash.

Norristown, Pa.—The following are reported to be the bids received June 10 by the Bldg. Com., State Hospital for the Insane, Southeast Dist. of Pennsylvania, for erecting 4 temporary pavilions on the grounds of the hospital: (*a*) frame construction; (*b*) steel construction: Lynch Bros., Philadelphia, *a* $62,863, *b* $83,600; Henderson & Co., *a* $66,148, *b* $85,748; John R. Wiggins & Co., *a* $70,900, *b* $90,900; John Morris, *a* $73,957, *b* $97,650; Wm. R. Dougherty, *a* $69,100, *b* $9,800; Peoples Bros., *a* $78,146, *b* $99,642; S. R. Heebner, *a* $65,609, *b* $83,709, and W. W. Lindsay, *a* $88,800, *b* $104,500.

Philadelphia, Pa.—Bids will be received by Maj. J. C. Sanford, Corps Engrs., U. S. A., Philadelphia, July 7, for furnishing metal work for foundation of the elbow of Cross Ledge Light Station, Delaware Bay, N. J., as advertised in The Engineering Record.

Pittsburg, Pa.—Muller & East, 4 8th St., it is stated, are preparing plans for a 5-story and basement fireproof hospital which is to be erected on Center Ave. for the Homeopathic Hospital.

Newport, R. I.—The following are reported to be the bids opened June 8 by Pay Director Drury, at Newport, for erecting a fireproof building at the Torpedo Station, near here, for the storage of torpedo boat supplies. Appropriation $30,000: Darling & Slade, Fall River, $29,950; J. W. Bishop Co., Worcester, $33,781; Maguire & Penniman, Providence, $34,646; M. A. McCormick, Newport, $36,646; Robert W. Curry, Newport, $38,000.

Deadwood, S. D.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., July 12, for a low-pressure steam heating apparatus complete for U. S. Post Office and Court House at Deadwood, as advertised in The Engineering Record.

Laredo, Tex.—It is reported that Ft. McIntosh, near this city, is to receive $100,000 improvements, including the addition of 1 barrack and 3 officers' quarters.

Ft. Myer, Va.—Bids will be received until June 24 by Capt. A. W. Butt, Q. M., U. S. A., Washington, D. C., for constructing, plumbing, gas piping, heating and electric wiring a building for bachelor officers' quarters at Ft. Myer.

**Two Rivers, Wis.*—Reckman & Son, of Kalamazoo, Mich., it is stated, have secured the contract to erect the court house at $159,200.

Milwaukee, Wis.—A. C. Clas, it is stated, has prepared plans for the stock judging building and the amphitheatre, which are to be erected in the State Fair Park. It is reported that the Bd. of Mgrs. (John M. True, Secy.) will probably soon ask bids for erecting the amphitheatre, which is to be a 2-story structure and to cost about $35,000.

Jecob, Yucatan, Mex.—It is stated that this town has appropriated $25,000 for the erection of a municipal building.

**Toronto, Ont.*—Contracts are reported to have been awarded as follows for work in connection with the erection of the Cowan Ave. fire hall, the total cost of which is to be about $21,565: Masonry, H. Lucas & Son, $9,170; carpentry, John McLeod, $5,500; steel work, Dominion Bridge Co., $1,320; plastering, Thos. Gander & Son, $916; galvanized iron and roofing, J. M. Bryan, $950; plumbing, Harrison & Robertson, $2,904; electric wiring, Keith & Fitzsimmons, $150.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Florence, Ala.—The Alpine Sanitarium Co., it is stated, has been incorporated with a capital of $200,000 for the purpose of erecting a sanitarium here. Dr. Chas. M. Watson, Pres.; T. M. Rogers, Vice-Pres., and A. E. Walker, Secy. and Treas.

Decatur, Ala.—It is stated that the Louisville & Nashville R. R. (W. H. Courtenay, Ch. Engr., Louisville, Ky.) and the Southern R. R. (W. H. Wells, Ch. Engr. of Constr., Washington, D. C.), intend erecting a depot here to cost about $50,000.

Mr. Brown, of Scottsboro, it is stated, intends erecting a hotel here at Vine and Railroad Sts., at a cost of $50,000.

Mobile, Ala.—The Knights of Columbus, it is stated, have accepted the plans prepared by Geo. D. Hurlbut, for the 5-story building which they propose erecting on St. Joseph St., of stone, brick and terra cotta, at a cost of about $50,000.

Birmingham, Ala.—It is reported that a $100,000 union depot is to be erected here to be used by the Southern R. R. (W. H. Wells, Engr. of Const., Washington, D. C.); 'Frisco system; Alabama Great Southern R. R. (Queen and Crescent); Central of Georgia R. R., and the Seaboard Air Line (W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.).

Little Rock, Ark.—It is reported that bids are to be received until July 15 for erecting a 6-story hotel at

**Items marked thus give the names of parties awarded contracts.*

Markham and Louisiana Sts. to cost about $250,000. Mann & Downey, of Little Rock, are the archts.

Pine Bluff, Ark.—T. R. McMahen and R. E. Ricksen, of St. Louis, it is reported, are organizing a company to erect a $20,000 theater here.

Los Angeles, Cal.—A. L. Haley, Henne Bldg., it is reported, has been authorized to prepare plans for 2 6-story brick building which Thos. Higgins intends erecting at 7th and Spring Sts. at a cost of $50,000.

E. B. Darling will erect for Andrew Brown a 3-story brick business building at 302 5th St., at a cost of $26,000.

The members of the Salvation Army in this city, it is stated, are contemplating the erection of a headquarters building, 7 stories high, as a memorial to the late Consul Booth Tucker.

*Contracts for the erection of buildings here are reported to have been awarded as follows: to Graham & Eaton, for a 3-story brick building on Olive and 6th Sts., to cost $31,050; architects, Dennis & Farwell, Currie Bldg.; to J. F. Hall, Builders' Exchange, for a 3-story store building on 16th and Main Sts., to cost $20,450, and to H. R. Angelo, for 2 brick store buildings in East Los Angeles for $57,800.

San Francisco, Cal.—Anna L. Whittel will erect a 15-story office building here to cost $100,000. Shea & Shea, architects, 26 Montgomery St.

Chas. J. Rousseau, 916 Market St., it is stated, is the arch, for a brick and stone fireproof building which is to be erected at 2d and Natoma Sts., at a cost of $100,000.

**Ocean Park, Cal.*—Crookshank & Somers, it is stated, have received the contract to erect a theatre here for H. C. Wyatt, of Los Angeles, at a cost of about $35,000.

**New Haven, Conn.*—Sperry & Treat, 39 Church St., have secured the contract for erecting a brick and iron building, to be used as a smoke house for the Sperry & Barnes Co. It will be 4 stories, 55x43 ft., and cost $16,000.

Peoria, Ill.—Parr & Hulsebus, Y. M. C. A. Bldg., it is stated, have about completed plans for the 4-story and basement building which is to be erected on Washington St. by Schipper & Block, at a cost of $30,000.

Evansville, Ill.—M. L. Lockyear, of Lockyear Business College, Chicago, it is reported, is interested in the erection of a 10-story steel fireproof office building which is to be erected on Main St., in this city.

Pekin, Ill.—Conklin-Reuling Co., of Pekin, submitted the lowest bid, according to reports, for the superstructure of the Edds Bldg., at $28,000.

Chicago, Ill.—A. E. Norman, 610 Forest Ave., has prepared plans for a building to contain flats, stores, offices and a hall, which is to be erected for Sivert F. Hollesen at Clark St. and Devon Ave. It will be 3 stories high, 194x66 ft., and cost $60,000.

D. H. Perkins, 17 Van Buren St., is preparing plans for a neighborhood building to be built at 67th and May Sts., for the Neighborhood Assoc. It will be a 2-story structure, 29x86 ft., and will cost $20,000.

Jas. Gamble Rogers, Ashland Blk., has made plans for a building to be erected in Lake Forest, in which the State Bank of Lake Forest is to be located. The building will be 3 stories high and cost $40,000.

Geo. O. Garnsey, 185 Dearborn St., has made plans for a stable to be erected at 61st and La Salle Sts., for the Hastings Express Co. The building will be 25x164 ft., of brick and stone and cost $20,000.

A building permit has been granted to Harriet B. Boiland, owner, to erect an 18-story, 50x100-ft. building at La Salle and Monroe Sts., to cost $650,000.

Plans are being prepared by Holabird & Roche, 1618 Monadnock Bldg., for an 17-story addition to the Marquette Bldg., which is to cost $700,000. The same archt. is preparing plans for an 11-story addition to the Auditorium Annex, the cost to be $750,000.

Indianapolis, Ind.—Plans have been filed for the Knights of Pythias Castle Hall, which is to be a 10-story structure and is to cost about $375,000.

**Boone, Ia.*—Park Bros., of Storm Lake, it is stated, have received the contract to erect the Eastern Star Masonic Home at $11,380. C. B. Sherman Co., of Boone, secured the contract for the plumbing of same.

Sioux City, Ia.—The Iowa Telephone Co. will erect a 3-story block for telephone purposes; cost, $15,000. W. W. Beach, Archt., 721 Toy Bldg.

Clinton, Ia.—A new Masonic temple is to be erected here at a cost of about $60,000.

Liberty, Ia.—It is reported that bids will be received July 1 by the Bldg. Com. (J. F. Pierc, Secy.) for erecting an Odd Fellows' Lodge Bldg.

**Louisville, Ky.*—Rommel Bros., 915 E. Bway., it is stated, have received the contract to erect the reinforced concrete office building and warehouse for the Belknap Hardware & Mfg. Co., at 2d and Washington Sts. The total cost of the building, including equipment, is reported to be about $200,000.

New Orleans, La.—It is reported that Shwartz & Isaacs will erect a 12-story steel building on Canal St. for the Maison Blanche.

The Y. M. Hebrew Assoc., it is stated, has decided to erect a 2-story building on the site of the structure which was destroyed by fire, the cost to be about $130,000.

**Boston, Mass.*—The Hallowell Granite Wks., Hallowell, Me., it is stated, have secured the contract for the granite work on the Suffolk Savings Bank Bldg., at about $60,000.

Detroit, Mich.—The erection of a new Y. W. C. A. building at a cost of $40,000 is reported under consideration.

Hancock, Mich.—F. M. Sackrider, of Houghton, it is stated, is contemplating the erection of a combined hotel and Elks Temple here, at a cost of $60,000.

**St. Paul, Minn.*—A permit has been issued for a 3-story brick building to be erected at Rice and Central Sts., for store and flats, to cost $25,000. Geo. Michel, owner; F. H. Bartels, contractor, 165 Fuller St.

**Crookston, Minn.*—D. W. Tully, of Barnesville, Minn., it is reported, has received the contract to erect the Grand Central Hotel at about $20,000.

Jackson, Miss.—R. H. Hunt, of Chattanooga, Tenn., is preparing plans for the department store to be erected for Jones-Kennington Co. It will be of brick, 6 stories and basement, 80 x 100 ft.

It is proposed to erect a Y. M. C. A. building at Jackson to cost $20,000. Address Chas. N. Bancroft, secy.

The Norvelle Hotel has changed hands, and it is reported that an addition will be made to cost about $30,000; address Frank G. Jones or S. T. Carnes, of Memphis, Tenn.

It is reported that a $40,000 addition to the Edwards Hotel will be made by the owner, I. C. Enochs, of Jackson.

St. Joseph, Mo.—J. F. Letton, Mgr. of the Hotel Metropole, it is reported, is interested in a company being organized for the purpose of erecting a hotel to cost $300,000.

Butte, Mont.—It is stated that plans have been prepared for a $100,000 depot which is to be erected by the Northern Pacific R. R. (E. J. Pearson, Ch. Engr., St. Paul, Minn.)

**Omaha, Neb.*—The Paxton & Vierlin Iron Wks., S. 17th and U. P. Ry., it is stated, have secured the contract for the structural iron and steel work for the Brandeis mercantile building, which is to be erected on Douglas and 16th Sts. The building is to be 8 stories high, 132x364 ft., and the total cost is to be about $200,000.

Omaha, Neb.—Dr. A. S. Wright, of Santa Rosa, Cal., it is reported, intends erecting a 3-story brick business building at 16th and Chicago Sts., this city, to cost about $20,000.

Berlin, N. H.—Stewart & Snodgrass, it is stated, secured the contract to erect the Odd Fellows' Bldg., at $14,579.

Newark, N. J.—J. T. Rowland, Jr., of Jersey City, it is stated, has prepared plans for the building which is to be erected by the Lodge of Elks on Green St., at a cost of $60,000. John Colyer, Chmn. Bldg. Com.

Las Vegas, N. Mex.—The Fraternal Orders of the United States, it is reported, have secured a site near here and intend erecting a sanatorium for consumptives.

Brooklyn, N. Y.—Lump sum bids are being received by the Bush Terminal Co. for the labor on the brick walls and reinforced concrete columns, girders and floors of a 600x75-ft. 6-story and basement factory. Further information will be furnished by the chief engineer, foot of 43d St.

Buffalo, N. Y.—Henry Brinkman, it is stated, is to erect a $60,000 store and flat building at Main and Ferry Sts.

The Polish Literary Assoc., it is stated, is to erect a 3-story brick building at 1079 Bway, to have stores on the ground floor, and to cost $32,000.

It is stated that the Chamber of Commerce intends erecting an 11-story building at Main and W. Seneca Sts., at a cost of about $1,000,000.

Aaron E. Sipe, Mooney-Brisbane Bldg., it is stated, is having plans prepared for a 4-story brick building which he intends erecting at 46 N. Pearl St., at a cost of $50,000.

Frankfort, N. Y.—The Pratt Chuck Co. will erect an addition 206x87 ft., but will not at present increase its power plant.

Rochester, N. Y.—The Chase Bros. Co. will erect buildings for the storage and packing of trees. The buildings will be about 300 ft. sq., 1 story 16 ft. high.

**Jamestown, N. D.*—The contract to erect an annex to the Gladstone Hotel, it is reported, has been awarded to Bowers Bros., of Fargo, at $22,490, and the contract for the plumbing and heating of same to E. J. Harrington, of Fargo, at $3,219.

Canton, O.—Archt. Bostick, of Massillon, is reported to have prepared plans for a 3-story business block, 40x200 ft., of brick and iron, for Aaron Hauser, to cost $30,000.

Elyria, O.—Plans have been approved, according to reports, for a Masonic temple to be 6 stories, of brick and stone and to cost about $60,000.

Cleveland, O.—Lehman & Schmitt, Garfield Bldg., it is reported, have been appointed to prepare plans for the hippodrome which is to be erected here at a cost of about $2,000,000.

Zanesville, O.—The contract to erect the building for the American Encaustic Tile Co., it is reported, has been secured by Evans Bros. and W. C. Handshy, both of Zanesville, at a total cost of $25,000.

**Athens, O.*—Chas. P. Krischer & Co., it is reported, have received the contract to erect the Athens National Bank at $26,983.

Cincinnati, O.—Anthony Kuntz, Jr., 95 W. Court St., it is stated, has been engaged to prepare plans for a 5-story store and flat building which is to be erected by John B. Gartner on Vine St., at a cost of about $30,000.

Portland, Ore.—The Wells Fargo Express Co., it is reported, has purchased a site at 6th and Oak Sts., and will erect an 8 or 10-story, fireproof brick building.

T. H. Stow, local manager of the Automatic Telephone Co., it is stated, has announced that his company intends to spend $100,000 on a new telephone building on the West Side of the city.

Williamsport, Pa.—See "Water."

Nashville, Tenn.—The Davies Piano Co. will erect large warehouse and workshop.

Chattanooga, Tenn.—Kirby-Mitchell & Co., it is reported, has secured a permit to erect a 2-story brick building on Market St. and Montgomery Ave., the cost to be about $23,000.

Knoxville, Tenn.—Jas. G. Sterchi, owner of the Hotel Stafford, it is stated, has announced that he will erect an annex to the hotel and make improvements, the total cost to be about $50,000.

San Antonio, Tex.—J. H. Daverman & Son, Porter Blk., Grand Rapids, Mich., it is stated, are preparing plans for a 7-story hotel which is to be erected here by the San Antonio Hotel Corporation, and it is estimated to cost $150,000.

Houston, Tex.—It is stated that the Houston Land & Trust Co., of Houston, will soon let contract for the erection of a 5-story, steel-frame office building.

Richmond, Va.—It is reported that the Confederate Veterans intend erecting a Battle Abbey here and have a $200,000 fund available for the purpose. Gen. Clement A. Evans, of Atlanta, Ga., Commander of the Dept. of Tenn., U. S. Confederate Veterans, may be able to give further information.

Seattle, Wash.—It is stated that Judge Thos. Burke will erect a 12-story building jointly with the American Savings Bank & Trust Co., at Madison and 2d Ave. A. Warren Vould, Boston, Mass., is the archt.

Spokane, Wash.—The Kirkwood Distillery Co., 915 Sprague Ave., it is stated, is contemplating the erection of a 2-story warehouse, 75x80 ft., at a cost of $20,000.

Tacoma, Wash.—Senator Geo. Turner, it is stated, is contemplating the erection of a theater, store and office building at Howard St. and 1st Ave., to cost about $100,000.

Milwaukee, Wis.—It is reported that as soon as the Governor signs the bill which has passed both houses of the Legislature, authorizing the erection of a new convention and music hall in this city to replace the structure which was recently destroyed by fire, a company will be formed, in which W. N. Fitzgerald is interested, for the purpose of erecting this building. Probable cost, $400,000.

Cheyenne, Wyo.—The F. E. Edbrooke Architectural Co., of Denver, Colo., is reported to have prepared plans for a 3-story brick and stone bank building for the Stock Growers' Assoc., to cost about $50,000.

NEW YORK, N. Y.

New York, N. Y.—342 E. 85th St., 6-story br. and stone store and tenement; c, $20,000; o, Saml. Newman; a, Horenburger & Straub.

215 E. 106th St., 2 6-story br. and stone stores and tenements; total, c. $60,000; o, Grossman & Sundelrich; a, Horenburger & Straub.

Bathgate Ave. and 173d St., 6-story br. store and tenement; c, $75,000; o, Wahling & Sonsen; a, Moore & Landsiedel.

64 Fulton St., 9-story br. and stone extension to 9-story br. and stone store and loft bldg.; c, $75,000, o, Chas. Buck and Fairfield Realty Co.; a, Chas. Brendon & Co.

St. Nicholas Ave. and 182d St., 2 5-story br. and stone stores and tenements; total c, $80,000; o, Wm. H. Bingham Plumbing & Constr. Co.; a, Neville & Bagge.

58 Cedar St., 8-story br. and stone office bldg.; c, $140,000; o, The Mutual Life Ins. Co.; a, Clinton & Russell.

Delancey St. and the Bowery, 4-story br. and stone hotel; c, $20,000; o, Driscoll & Horn; a, Hehule, Huberty & Hudswell.

234 Mott St., 6-story br. and stone store and tenement; c, $20,000; o, Michael Scangarella; a, Horenburger & Straub.

401 Washington St., 6-story br. and stone warehouse; c, $90,000; o, Rogers Tea & Coffee Co.; a, Maynicker Franke.

211 W. 19th St., 5-story br. and stone factory and warehouse; c, $50,000; o, Ketterer & Co.; a, Ross & McNeil.

Courtlandt Ave. and 159th St., 5-story br. stores and tenements; c, $5,000; o, Chas. Brown; a, Geo. F. Pelham.

East End Ave. and 81st St., alterations to 2 3-story br. and stone store bldgs; c, $25,000; o, Fleischmann Vienna & Model Bakery Co.; a, Stein, Cohen & Roth.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Matthias Johnson, it is stated, is having plans prepared by C. A. Meussdorffer, Parrott Bldg., for a brick and terra cotta apartment house which he intends erecting at Fell and Franklin Sts., at a cost of $100,000.

San Francisco, Cal.—The Ansgar Danish Evangelican Lutheran Church, it is reported, intends erecting an edifice at a cost of $20,000. Rev. P. E. L. Hansen, Pastor.

**San Francisco, Cal.*—Contract is stated to have been awarded to M. F. Gale & Son, for a 6-story apartment house, to cost $60,000.

**New Haven, Conn.*—Contracts for erecting an edifice on Elm St., for the First Presbyterian Church Society have been awarded as follows: Mason work, Sperry & Treat, 39 Church St., and carpenter work, Wm. Paterson, 8848 Chapel St.; total cost, about $65,000.

Springfield, Ill.—Logan Hay, it is stated, intends erecting a residence on South Grand Boule, to cost $50,000.

Oak Park, Ill.—C. E. Roberts is Chmn. of the Bldg. Com. of the Unity Church, which has in charge the building of a new edifice to replace the structure which was recently destroyed by fire. Probable cost, $50,000.

Chicago, Ill.—The St. Bridget's R. C. congregation will erect a new brick and stone church at 2950 Archer Ave., after plans by Egan & Prindeville, 85 Dearborn St. Cost, $85,000.

Plans have been prepared by Jos. Molitor, 160 Washington St., for a church for the R. C. congregation of SS. Peter and Paul, Rev. M. Relik pastor. It is to be built at 31st St. and Central Park Ave., and will cost $50,000.

T. N. Bell has prepared plans for 2 apartment buildings to be built on Washington Boule. and 51st Ave. and 51st Place for Robt. L. Martin, Jr. Both buildings will be 2 stories high and the cost is estimated at $90,000.

Henry L. Newhouse is preparing plans for a group of 4 apartment houses to be built in the Hyde Park district for John E. Dubach, the builder, at a total cost of $75,000. Each of the structures will be 3 stories high, 150 x75 ft.

L. Mart Mitchell, 145 La Salle St., has plans for a 3-story apartment building, to be built on Washington Boule., near 48th Ave., for Arthur L. Hardin and J. W. Taylor. Cost $60,000.

Chas. F. Sorenson, 648 N. Claremont Ave., is preparing plans for a flat building, to be built at Belden and Sawyers Aves., for Arnold Jensen. It will be a 3-story structure, 50x140 ft. and cost $45,000.

William G. Krieg, 84 Washington St., is preparing plans for a 3-story apartment building, 52x118 ft., to be built for Pruitt & Moore on Sheridan road, near Lawrence Ave., at a cost of $40,000.

Indianapolis, Ind.—The Bd. of Trus. of the Broadway Methodist Church, it is reported, is contemplating the erection of a $30,000 edifice. Rev. W. M. Tippy, Pastor.

Huntington, Ind.—It is reported that the First Christian Church will receive bids until June 24, for erecting a new edifice, probable cost, $25,000.

Evansville, Ind.—The members of the Central Methodist Church, it is stated, have purchased a site at Frank-

**Items marked thus give the names of parties awarded contracts.*

lin and Mary Sts., and intend erecting a $15,000 edifice J. B. Miller, Secy. Bd. Trus.

*_Baltimore, Md._—Henry Smith & Sons, 116 Regester St., it is stated, have secured the contract to make alterations and erect addition to the Brown Memorial Presbyterian Church, the cost of which is to be about $30,000.

*_St. Paul, Minn._—Geo. J. Grant, of St. Paul, it is stated, has received the contract to erect the St. Bernard R. C. Church, at Albemarle and Rose Sts., at a cost of $67,250.

Perham, Minn.—It is stated that bids will be received until June 26 by the Bldg. Com. of St. Henry's congregation for erecting a brick church for the said congregation.

Camden, N. J.—Thos. Stephens, of Camden, is reported to be preparing plans for a large apartment house for Camden.

Brooklyn, N. Y.—The members of the 15th St. Baptist Church, it is stated, have had plans prepared by Ackerman & Partridge, of New York City, for an edifice which they propose erecting on 4th Ave. at a cost of $30,000.

Buffalo, N. Y.—A building permit has been granted to Rev. Thos. Donohue, pastor of the Church of the Immaculate Conception, for a rectory to be erected at 125 Edward St., at a cost of $17,000.

Akron, O.—Henry & Son, of Akron, it is reported, are preparing plans for a new edifice which the English Lutheran Church congregation intends erecting.

Canton, O.—Ferdinand Herbruck will erect a brick and stone residence on Market and Lake Sts., to cost $12,000. Architect, Guy Tilden, Schafer Blk.

Youngstown, O.—Owsley & Boucherle, Wick Bank Bldg., it is stated, are preparing plans for an edifice for the M. E. Church, the cost to be about $85,000.

*_Mt. Airy, Pa._—Geo. A. Glenn & Co., of Philadelphia, it is reported, have secured the contract to erect the Mt. Pleasant M. E. Church at Mt. Pleasant Ave. and Bryant St., at a cost of about $30,000.

Milwaukee, Wis.—A building permit has been granted to the congregation of St. Matthew's Church to erect an edifice at 20th Ave. and Scott St., at a cost of about 25,000.

NEW YORK, N. Y.

Madison Ave. and 55th St., 10-story br. and stone tenement; c, $225,000; o, Jas. A. Farley; a, Thain & Thain.

136th St. and 5th Ave., 2 6-story br. and stone tenements; total c, $100,000; o, Levy & Friedman; a, Bernstein & Bernstein.

138th St. and Bway, 5-story br. and stone tenement; c, $50,000; o, Cohen & Perehman; a, Geo. F. Pelham.

147th St. and Amsterdam Ave., 3 5-story br. and stone tenements; total c, $150,000; o, Weingarten & Chopak; a, B. W. Levitan.

148th St. and 8th Ave., 5-story br. and stone tenement; c, $40,000; o, Nevius & Perelman; a, Geo. F. Pelham.

Lenox Ave. and 148th St., 4 -6-story br. and stone tenement; total c, $210,000; o, Meyer Frank; a, Geo. F. Pelham.

Barretto and Home Sts., 5-story br. tenement; c, $50,000; o, Jas. Reynolds; a, Harry T. Howell.

137th St. and Southern Boule, 2 5-story br. tenements; total c, $83,000; o, Robertson & Gammie; a, Schwartz & Gross.

138th St. and St. Ann's Ave., 7 6-story br. tenements; total c, $210,000; o, N. W. Realty Co.; a, M. J. Garvin.

140th St. and St. Ann's Ave., 6 5-story br. tenements; total c, $180,000; o, Rankin Bros.; a, M. J. Garvin.

153d St. and Courtlandt Ave., 2 6-story br. tenements; total c, $60,000; o, Werner Knaus Realty Co.; a, M. J. Garvin.

Boston Rd. and Union Ave., 5-story br. tenement; c, $20,000; o, Edw. J. Bradley; a, Bernstein & Bernstein.

Cypress Ave. and St. Mary's St., 5 5-story br. tenements; total c, $150,000; o, Hyman Schulman; a, Harry T. Howell.

Jackson Ave. and 161st St., 5-story br. tenement; c, $50,000; o, Barney Kaplan; a, Goldner & Goldberg.

Prospect Ave. and Kelly St., 4 5-story br. tenements; total c, $160,000; o, Prospect Ave. Realty Co.; a, Moore & Landsiedel.

St. Ann's Ave. and St. Mary's St., 5-story br. tenement; c, $40,000; o, J. K. McAfee; a, M. J. Garvin.

St. Mary's St. and St. Ann's Ave., 2 5-story br. tenements; total c, $60,000; o, Rankin Bros.; a, M. J. Garvin.

Vyse Ave. and 167th St., 21 3-story br. dwells.; total c, $168,000; o, Trans-Harlem Land & Improvement Co.; a, Moore & Landsiedel.

Wendover and Park Aves., 4 6-story br. tenements; total c, $150,000; o and a, Albert J. Schwarzler.

SCHOOLS.

Notes Arranged Alphabetically by States.

Santa Rosa, Cal.—School bonds amounting to $35,000 have been sold.

San' Francisco, Cal.—The Bd. of Educ. has purchased a site in Silver Terrace, on which it is proposed erecting the Burnett Grammar School, the cost of which is to be about $119,000.

Downey, Cal.—The citizens, it is reported, have voted in favor if issuing $20,000 bonds to erect a high school.

Hartford, Conn.—Wm. D. Johnson, 26 State St., it is stated, is preparing plans for alterations and improvements to the Northwest School, which are estimated to cost $45,000.

Washington Barracks, D. C.—It is reported that all bids received May 13 for the ornamental terra cotta work at the Army War College at Washington Barracks have been rejected and new bids are to be received.

Lake City, Fla.—The Co. School Bd., it is stated, has given $10,000, to be added to a like sum given by the City School Bd., for the erection of a high school.

Wrightsville, Ga.—The Nannie Lou Warthier Inst., it is stated, is contemplating the erection of a new building at a cost of about $20,000. Prof. P. F. Brown is Pres.

Chicago, Ill.—The Sisters of St. Mary have purchased a site at Western and York Sts. and intend erecting a private school costing $75,000.

Ottawa, Ill.—The Township Bd. of Educ., it is reported, has authorized Principal J. O. Leslie to engage an archt. to submit plans and estimates of the cost of remodeling the high school and erecting additions to the south and east sides.

Centralia, Ill.—It is stated that school bonds amounting to $18,000 have been sold.

*_Chandlerville, Ill._—E. O. Trowbridge, of Petersburg, it is stated, has received the contract to erect the school at $11,400.

Indianapolis, Ind.—It is reported that bids will be received until June 29 by the Bd. Trustees (E. M. Johnson, Secy., 205 State Life Bldg.) for erecting 7 cottages, a school, power house and refrigerator plant at the Industrial School for Girls, 5 miles from here; Clarence Martindale, Archt., Indiana Trust Bldg.

Jefferson, Ia.—It is reported that bids will be received until June 26 by the School Bd. (J. W. Fritz, Secy.) for erecting a high school for the Independent Dist.

Jennings, La.—It is stated that bids will be received until July 1 by J. C. St. Germain, City Clk., for $35,000 school bonds.

Arcadia, La.—Bids will be received until June 24 by J. Rush Wimberly, Supt. Schools, for erecting a 2-story school; Honold & Gauthier, Archts., Abbeville.

*_Haverhill, Mass._—The contract to install the heating and sanitary systems in the school in the 5th Ward, it is stated, has been awarded to the Fuller & Warren Co., 43 Milk St., Boston, at $2,150.

Watertown, Mass.—Chas. Brigham, of Watertown, it is stated, has completed plans for the 8-room school which it is proposed erecting at a cost of $45,000.

*_Worcester, Mass._—Edwin Hawes & Co., 17 Vine St., it is stated, have secured the contract for installing the heating plant in the Abbott St. School at $3,293.

The alteration of the Edgeworth St. School and the erection of a 6-room addition to same, is reported under consideration. Probable cost, $30,000.

Amherst, Mass.—Jas. Draper, of Worcester, Chmn. Bldg. Com., Agricultural College, writes that the contract for erecting a horticultural building at Massachusetts Agricultural College at Amherst (bids opened June 10) has been awarded to D. W. Blodgett and G. E. Bosworth, of Amherst, for $25,582.

Holyoke, Mass.—The Bd of Pub. Wks. is reported to have been instructed to have plans prepared for a 16-room school for South Holyoke, to cost $60,000.

Norway, Mich.—School bonds amounting to $40,000 have been sold.

*_Ann Arbor, Mich._—Grove J. Ray, Secy. Bd. Educ., writes that the contract for erecting a high school and public library (bids opened June 12) has been awarded to E. M. Camfield, of Findlay, O., for $250,738.

Rhinelander, Minn.—It is stated that bids will be received until June 21 by the Bd. Educ. (Gust. Swedburg, Clk.) for erecting a ward school. Parkinson & Dockendorff, archts., La Crosse, Wis.

Minneapolis, Minn.—The Bd. of Regents of the State Univ., it is reported, has selected a site and instructed the archt. to prepare plans for the administration building which is to be erected at the Agricultural School, for which $225,000 is available.

*_Winona, Minn._—M. Toye, of Winona, has secured the contract for ventilating and heating the Normal School, and John Lohse, of Winona, for repairing roof of main building (bids opened June 7); total cost of work, $35,000.

Northfield, Minn.—The plans of Bertrand & Chamberlin, Bank of Commerce Bldg., Minneapolis, it is stated, have been accepted for the science hall, which it is proposed erecting at Carleton College, the cost to be about $50,000.

Vandalia, Mo.—Bids will be received June 29 by the Bd. Educ. (A. L. Branstetter, Secy.), for erecting a 14-room school; J. M. Dunham, Archt., Odd Fellows' Bldg., St. Louis.

Eldon, Mo.—It is reported that bids will be received until June 20 for $13,500 school bonds.

New York, N. Y.—Bids will be received until June 26 by C. B. J. Snyder, Supt. School Bldgs., for general construction, etc., of additions to School No. 71, and for repairs to heating apparatus in 19 schools, Boro. Manhattan; also for improving the sanitary condition, etc., of Schools No. 34, Queens, and No. 72, Maspeth; alterations, repairs, etc., in School No. 26, Flushing; installing, ventilating and heating apparatus in addition to School No. 71, Metropolitan, all in Boro. Queens.

New York, N. Y.—Plans have been filed for a 4-story seminary building, to be erected for the Ursuline Convent of St. Theresa, at 93d St. and Park Ave. It is to be of ornamental brick, trimmed with limestone, and will cost $25,000. Jos. H. McGuire, Archt., 45 E. 42d St.

McKim, Mead & White, archts., 160 5th Ave., have filed plans for Hamilton Hall, a gift to Columbia University, which is to be erected at 116th St. and Amsterdam Ave. It is to be a 5-story fireproof structure, 205x52 ft. It is to have a colonnaded facade of brick, decorated with granite and limestone trimmings. The cost is estimated at $350,000.

Falconer, N. Y.—It is reported that plans have been prepared by E. E. Joralemon, of Niagara Falls, for a school to be erected here at a cost of $33,000.

Jamestown, N. Y.—The Bd. of Educ. has recommended to the taxpayers the building of a 20-room grammar school at a cost of $60,000.

Albany, N. Y.—Bids will be received until July 3 by the Bd. Contract and Supply (Isidore Wachsman, Clk.) for furnishing materials and erecting, including plumbing and heating work, School No. 16.

Charlotte, N. C.—Hook & Rogers, of Charlotte, it is stated, have been engaged to prepare plans for a 3-story brick dormitory, a chapel and an auditorium, which are to be erected at Catawba College, of which Rev. Geo. Albert Snyder is Pres.

Durham, N. C.—It is stated that plans are soon to be prepared for a school which it is proposed erecting at a cost, including equipment, of $50,000.

Wahpeton, N. D.—Bids will be received until July 18 by the Comr. Indian Affairs, Dept. Interior, Washington, D. C., for furnishing materials and constructing, complete, 2 dormitories, a school house, mess hall, laundry and warehouse, all of brick, with plumbing, steam heat and electric light; also water, sewer and electric lighting systems at the site of the new school near Wahpeton.

East Liverpool, O.—Bids will be received July 3 by the Bd. Educ. (Walter B. Hill, Clk.) for furnishingg materials and erecting a school at Pennsylvania and Elizabeth Aves.

Toledo, O.—It is stated that $170,000 has been appropriated by the Bd. of Educ. for additions to schools, to be distributed as follows: An 8-room addition to Hoag School, $30,000; 4-room addition Ontario St. School, $17,000; 6-room addition Raymer School, $20,000; 4-room addition to Glenwood, $15,000; 6-room addition to Spring, $20,00; 4-room addition to Indiana, $17,000; 4-room addition to Ironville, $17,000, and a 4-room addition to Chase, $15,000.

*_Wellsville, O._—The contract to erect the addition to the West End School, it is stated, has been secured by Forbes & Smith, of Wellsville, at $12,328.

Cleveland, O.—Bids will be received until July 10 by the Bd. Educ. (Geo. E. Myers, Clk.) for furnishing materials and completing an addition of 6 class rooms and an assembly room at the Kinsman School, including ventilating and heating, electric wiring, plumbing and gastting; also same date for furnishing materials and completing the plumbing and sewers in the Woodlawn School.

Cleveland, O.—It is stated that school bonds amounting to $300,000 have been sold.

Oklahoma City, Okla. Ter.—School bonds amounting to $60,000 have been sold.

Portland, Ore.—The Bd. of Educ. has decided to erect the high school on the East Side, in accordance with plans prepared by T. J. Jones, 334 E. 3d St. It is to be a 3-story and basement, brick, terra cotta and stone building, and is to cost about $100,000.

Pittsburg, Pa.—The erection of a school in the 13th Ward at a cost of about $250,000 is reported under consideration.

Homestead, Pa.—The School Bd. of West Homestead, it is stated, has decided to erect a new Central High School costing about $25,000.

North Providence, R. I.—Bids are wanted for erecting additions to the Centredale, Lymansville and Marieville schools; Geo. M. Hall, High Service Ave.

Clio, S. C.—It is reported that bids are wanted until June 26 for $10,000 school Dist. No. 9 bonds. Address C. H. Herring.

*_Bismarck, S. D._—The contract to erect the high school, it is stated, has been awarded to Hoglund Bros., of Hastings, Minn., at $15,000..

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Nashville, Tenn.—A bill has passed second reading, providing for the issue of $300,000 bonds for a new high school.

Madison, Wis.—Bids will be received June 26 by the Regents of the Univ. of Wisconsin (J. F. Riley, Secy.) for erecting a farm engineering building; plans and specifications may be had upon a deposit of $10.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

*_Bloomington, Ill._—D. T. Foster has secured the contract for removal of garbage, ashes, etc., at $7,500 per year.

Detroit, Mich.—The House and Senate are stated to have passed the bill authorizing this city to establish a municipal garbage plant.

Duluth, Minn.—Specifications are being prepared for a garbage burner. Dr. D. D. Murray, Health Comr.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Anheuser-Busch Brewing Association, St. Louis, Mo., has made application for a permit to construct a 7-story, 100 x 350-ft. stock house at Ninth and Arsenal Sts., at a cost of $250,000, according to local newspaper reports.

The trustees of the estate of L. V. Paine Freer, Chicago, Ill., will build a 10-story, 20x180-ft. addition to their manufacturing block, at Washington and Market Sts., at a cost of $75,000, according to local newspaper reports. J. C. Llewellyn, archt.

Geo. D. Claflin, Jr., 39 Cortlandt St., New York, has charge of the equipment of a 2,500-bbl. cement plant at Pattenburg, N. J., for the Ajax Portland Cement Co. The plans include a 140x320-ft. main building, a 48x100-ft. grinding room, a 50x60-ft. boiler house, and an 80x100-ft. engine room. Steam power will be used and a power plant of 2,400 h. p. will be installed.

The New Process Raw Hide Co., Syracuse, N. Y., has let contract for a 2-story, 80x60-ft. brick building to double the capacity of its machine shop. The company is using electric power furnished by the Syracuse Lighting Co., and will, therefore, require no additional power plant.

The Hartje Paper Mfg. Co., 113-115 Wood St., Pittsburg, Pa., contemplates building an addition to its plant at Steubenville, O., but details regarding it are unavailable.

Dean & Main, 53 State St., Boston, Mass., are engineers for a plant to be built in Montreal by the Walter M. Lowney Co., of Canada, Ltd. The plant will include a 6-story, 100x55-ft. brick factory building, an addition of about 100x27 ft. for the boiler, engine and refrigerating plants, and a machine shop and coal pocket. There will be three small engines with direct-current electric generators on their shafts, two of 80 kw. each and one of 30 kw. There will be two 150-h.p. vertical fire tube boilers, a 40-ton refrigerating plant, and the coal pockets will have a capacity of 80 tons.

The Knoxville, Tenn., Woolen Mills will erect a 2-story and basement, 50x100-ft. addition to its plant, which will require about 50 h. p.

Judd Phillips, Liberty, Ky., is interested in a stock company which is being formed to erect a 50-bbl. flour mill. Most of the stock has been subscribed.

The Iowa Fence & Wire Works, Carroll, Ia., expects to start a small plant, and will need motors and other factory equipment. J. E. Griffith, secy.

*_Items marked thus give the names of parties awarded contracts._

The Brundidge, Ala., Fertilizer Co. will erect a 40x105-ft. building, and is in the market for 30 to 40 h. p. engine and boiler.

The Hays Mfg. Co., Erie, Pa., maker of water and gas specialties, is erecting a new plant, which will consist of a 2-story, 50x160-ft. machine shop and a 60x198-ft. foundry. Details as to the power equipment have not yet been decided.

The Eagle Knitting Co., Hamilton, Canada, intends to erect a new building within the next year, but probably will not prepare plans before September or October.

The Abel & Bach Co., Milwaukee, Wis., maker of trunks and traveling bags, is erecting a 5-story, 180x150-ft. warehouse, the power plant for which will include an engine of about 200 h. p. capacity, boilers and electrical equipment, such as dynamos, motors, etc.

Dozier & Gay, 22 East Bay St., Jacksonville, Fla., are preparing to equip a paint factory, and have not yet ordered grinding machinery.

The Minter City, Miss., Brick & Tile Co. is erecting a 4-story, 244x80-ft. frame building and will also erect a 100x40-ft. boiler and machine room of concrete blocks. A 150-h.p. engine and two 100-h.p. boilers will be installed.

The Worth Bros. Co., Coatesville, Pa., is erecting a mill that will contain finishing rolls 132 ft. long, furnaces, soaking pits, straightening rolls, guillotine shears, etc.

The Worcester Wire Goods Co., Worcester, Mass., has had plans prepared for a large addition to its works. Reginald Washburn is treasurer of the company.

The Gray Envelope Co., Worcester, Mass., will erect a 4-story factory. Charles W. Gray is president of the company.

The Ohio Pattern Works, 814-818 Broadway, Cincinnati, O., will erect a new plant in the fall.

The Tennessee Valley Fertilizer Co., Florence, Ala., will erect a 160x280-ft. building and install equipment for grinding phosphate rock, making acid phosphate and bagging fertilizers and all other incidental machinery. Lee Ashcraft, Gen. Mgr.

The Clark Coal & Coke Co., 301-302 Second National Bank Bldg., Pittsburg, Pa., contemplates increasing the capacity of its brick plant to at least 15 kilns. The company's property is located in Butler and Armstrong Counties.

The Chicago Hardware Foundry Co., North Chicago, Ill., is in the market for an elevator for a warehouse and office addition to its plant.

The Patton-Hartfield Co., Memphis, Tenn., will erect a 50,000-bu. grain elevator during the fall, according to local newspaper reports.

The Atlanta (Ga.) Agricultural Works will erect a new factory, according to local newspaper reports. C. L. King, Pres.

John D. Wing, Atlanta, Ga., has bought a site for the erection of a candy factory.

Contract has been let for a machine shop to cost $20,000 for Max Braudy & Sons, Grand Rapids, Mich., according to local newspaper reports.

The U. S. Specialty Co., Marion, Ind., will remove its plant to new buildings it has purchased and will buy new equipment, according to local newspaper reports.

The Davis Foundry & Machine Co., Rome, Ga., will erect a plant for the manufacture of water wheels and ore washers and to do a general repair and machinery supply business.

The Chapinville Wheel Co., Poughkeepsie, N. Y., is erecting a new plant, which will include blacksmith, paint and woodworking and erecting shops.

Bigelow & Davis, oil well supply dealers, with headquarters at Findlay, O., and branches in the principal oil regions, are building new shops at Findlay upon the site of the old Ohio Rolling Mill, which plant they have just dismantled. The 18-in. mill has been shipped to Lorain, O., and the 10-in. mill to Ft. Worth, Tex. The muck-bar mill and power plant still remain. The new machine shops will be equipped with pipe machines and up-to-date equipment.

The William A. Harris Steam Engine Co., Providence, R. I., has bought the plant of the New England Electric Rivet Co. in Central Falls and as soon as practicable will remove its extensive machine shop to Central Falls. The proposed improvements include the building of a steel and brick machine shop 300 to 350 ft. long, together with an iron and a brass foundry. The main offices of the concern will remain in Providence.

D. X. Murphy & Bro., Louisville, Ky., are preparing plans for a new plant to be erected for the Falls City Clothing Co.

The Protected Metal Co., Carr Bldg., Springfield, Mass., is about to engage in the manufacture of a new roofing and siding material. The company is undecided as to the location of its plant, and its present power requirements amount to about 50 to 75-h.p. electric motors to be used to drive machines.

The Ohio Cultivator Co., Bellevue, O., will erect a 75x300-ft. foundry of steel construction, using its present foundry for a grinding and fitting room. A large warehouse and a 50x100-ft. fireproof pattern room will also be erected. The company has acquired the plant of the Bissell Chilled Plow Works at South Bend, Ind.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids are wanted July 14 for dredging in Mobile Harbor, as advertised in The Engineering Record.

Wilmington, Del.—The following are the bids opened June 10 by Capt. C. A. F. Flagler, Corps Engs., U. S. A., for dredging in Murderkill River, Del. (price given per cu. yd.): Houston-Rickards Dredging Co., Philadelphia, Pa., 9⅞ cts.; Patk. Neary, Wilmington, 10 cts.; Wilmington Dredging Co., Wilmington, 12 cts., and Chas. P. Grim, Philadelphia, Pa., 13⅜ cts.

Wilmington, Del.—Bids will be received July 6 by Capt. C. A. F. Flagler, Corps Engrs., U. S. A., for dredging Mispillion River.

Washington D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received June 27 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yard, Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies, as follows: steel plates; cement; iron; crane; steel pipe; water heaters, etc.; bids will also be received same date for furnishing at the navy yard, Pensacola, Fla., and the naval stations, Key West, Fla., and New Orleans, La., a quantity of naval supplies, as follows: Portland cement; electrical wire; combined blower and exhauster, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

Jacksonville, Fla.—Bids are wanted July 12 for dredging and rock removal in Withlacoochee River Entrance, Fla., as advertised in The Engineering Record.

Pensacola, Fla.—Bids will be received July 15 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for a coal-handling and storage plant at the navy yard, Pensacola.

Chicago, Ill.—See "Public Buildings."

Chicago, Ill.—Bids are wanted July 7 for furnishing material and constructing a 16-ft. conduit (tunnel) in Lawrence Ave., as advertised in The Engineering Record.

New Orleans, La.—Bids will be received July 5 by Capt. J. F. McIndoe, Corps Engrs., U. S. A., for furnishing about 23,000 tons of rock and about 4,500 tons quarry spalls at points on the Mississippi River.

**Plaquemine, La.*—The contract for excavation and construction of approaches at Plaquemine, bids opened on May 29, by Lieut. Col. Clinton B. Sears, Corps Engrs., U. S. A., New Orleans, has been awarded to W. O. Burton & Co., 400 Godchaux Bldg., New Orleans, for $110,220. For list of detailed bids received for this work, see issue of The Engineering Record June 10.

Portland, Me.—Bids are wanted July 15 for dredging in Portland Harbor, Me., as advertised in The Engineering Record.

**Boston Mass.*—Hiram A. Miller, Ch. Engr. Charles River Basin Comn., writes that the contract for constructing the Boston marginal conduit, Sect. 2 (bids opened June 1) has been awarded to Jas. Driscoll & Son, Box No. 46, Brookline, for $50,600. For list of bids received for this work, see issue of The Engineering Record June 10.

Bids will be received until July 14 by Col. W. S. Stanton, Corps Engrs., U. S. A., Boston, for dredging in Chelsea Creek, Boston Harbor, Mass.

Col. W. S. Stanton, Corps Engrs., U. S. A., writes that the following are the bids opened June 14 for furnishing about 300,000 tons of rubblestone, to be delivered in breakwater at Sandy Bay (price given per ton of 2,000 lb.): Federal Contr. Co., New York, N. Y., 60 cts.; Pigeon Hill Granite Co., Rockport, Mass., 76½ cts.

Lynn, Mass.—The following are the bids opened on June 12 by Col. W. S. Stanton, Corps Engrs., U. S. A., Boston, for dredging in Lynn Harbor (*a*) 646,000 cu. yds. dredging (*b*) removing bowlders weighing over 3 tons each: J. S. Packard Dredging Co., Providence, R. I., *a* 21.9 cts.; *b* $20. Bay State Dredging Co., Boston, *a* 20.95 cts.; *b* $5. Morris & Cumings Dredging Co., New York City, *a* 23 cts.; *b* $16.

Detroit, Mich.—Maj. Lansing H. Beach, Corps Engrs., U. S. A., writes that the following are the bids opened June 10 for building concrete superstructure on main pier at Harbor Beach, harbor of refuge, Mich. (Appropriation available reported to about $200,000.) (*a*) Rudolph S. Blome Co., Chicago, Ill., (*b*) The Murray Co., Contractors, Saginaw, (*c*) Hugo & Tims, Duluth, Minn.:

	a	*b*	*c*
Removing old superstructure and leveling cribs, per lin. ft.	$14.00	$8.50	$25.00
Pine or hemlock timber, per M. ft.	48.00	35.00	85.00
Iron bolts and spikes, per lb....	.06	.03	.05
Rail dowels, per lb.	.05	.02	.05
Concrete block, per cu. yd.....	9.75	8.50	9.00
Mass concrete, per cu. yd......	9.25	8.50	9.00
Mooring posts, each...........	60.00	50.00	45.00
Oak fenders, per M. ft........	75.00	50.00	80.00
Tie rods, each	10.00	7.00	10.00
Total, per lin. ft.	$120.19	$108.62	$139.32

Detroit, Mich.—The Canada & Michigan Bridge & Tunnel Co. and the Michigan & Canada Bridge & Tunnel Co., at a meeting held June 8, voted to consolidate the Detroit River Tunnel Co., a Michigan company with $4,000,000 capital stock. This company will construct the tunnel of the Michigan Central R. R. under the Detroit River, work on which will probably begin about Oct. 1.

Glendive, Mont.—The following are the bids opened June 1 at the office of H. N. Savage, Superv. Engr., U. S. Reclamation Service, Glendive, for the construction of a telephone system, having 4 telephone stations and about 70 miles of pole wire, from Glendive to a point opposite Buford, N. D.: Elmer A. Hess, Lyons, Ia., $14,939; Wm. F. Jordan, Glendive, Mont., $16,986; Frank C. Hughes, Glendive, $17,840; W. H. Crumb & Co. Chicago, Ill., $18,615, and Burrell Constr. Co., Portland, Ore., $23,710.

**North Platte, Neb.*—J. H. Quinton, Superv. Engr., U. S. Reclamation Service, Denver, Colo., writes that contracts for constructing about 45 miles of main canal for irrigation of lands in North Platte Valley, Wyo. and Neb. (bids opened May 16) have been awarded as follows: To Robinson & Maney, Chemical Bldg., St. Louis, Mo., for six of the ten sections: Sect. 1, $40,599; Sect. 2, $42,332; Sect. 6, $35,335; Sect. 7, $35,135; Sect. 9, $33,267, and Sect. 10, $29,700. To Griffin & McDermott, Merchants' Loan & Trust Bldg., Chicago, Ill. Sect. 3, $78,135. To Deadwood Constr. Co., Deadwood, S. D., Sect. 4, $32,695. To Orman & Crook, Pueblo, Colo., for Sect. 5, $76,647 and to Jas. O'Connor, Morgantown, Ind., for Sect. 8, $37,560. For list of bids received for this work see issue of The Engineering Record June 3.

New York, N. Y.—Bids will be received until June 22 by Nicholas J. Hayes, Fire Comr., for furnishing and delivering valves, steam cocks, nozzles, etc; also iron and steel for the repair shops, Boros. Manhattan and Bronx.

Bids will be received until June 26 for furnishing materials and building a pier bet. Catherine and Market Slips, East River, to be known as Pier 28; also same date for a pier near ft. Wall St., to be known as Pier 13, East River, Boro. Manhattan.

Brooklyn, N. Y.—Bids will be received until June 29 by the Park Bd. (John J. Pallas, Pres., New York City) for repairs and alterations to railing and wall at flower garden, Prospect Park, Brooklyn.

**Ogdensburg, N. Y.*—The following are the bids opened June 6 by Lieut. Col. H. M. Adams, Corps. Engrs., U. S. A., Buffalo for channel excavation at Ogdensburg Harbor, 55,000 cu. yds. (price given per cu. yd.): Daly & Hannan Dredging Co., Ogdensburg, 25 cts.; total, $14,000 (recommended for award). Lake Erie Dredging Co., Buffalo, 26½ cts., and Buffalo Dredging Co., Buffalo, 29 cts.

Wilmington, N. C.—Bids are wanted July 10 for a boiler for U. S. Suction Dredge Cape Fear, as advertised in The Engineering Record.

Cleveland, O.—It is stated that bids will be received until June 20 by the Bd. Pub. Service (A. R. Callow, Secy.) for grading, draining and otherwise improving a portion of Edgewater Park.

Philadelphia, Pa.—Bids will be received July 1 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C., for furnishing and installing underground cables at the navy yard, League Island, Pa.; bids will be received same date for dredging 110,0000 cu. yds., more or less, of material from Delaware River Navy Yard, League Island, Pa.

**Onawa, Ia.*—C. B. Ellis, Co. Aud., writes that contracts for constructing drainage ditches in Monona and Harrison Counties (bids opened June 8) have been awarded as follows: To Canal Constr. Co., 40 Dearborn St., Chicago, Ill., for Sect. No. 1, 970,174 cu. yds. black loam, 11½ cts. per cu. yd., and 556,106 cu. yds. black loam at 13½ cts. To Faris-Kesl Constr. Co., Ltd., Boise, Idaho, Sects. Nos. 2 and 3, consisting of 1,686,267 cu. yds. black loam, 12½ cts., and to Fred. M. Crane, Little Sioux, Ia., for Lateral No. 1 Dryditch, 50,165 cu. yds. black loam, 11 cts.

Block Island, R. I.—Bids will be received by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., Newport, on July 8 for constructing extension to jetty at entrance of Great Salt Pond, Block Island; also same date for dredging entrance channel to Great Salt Pond, Block Island, both advertised in The Engineering Record.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

**Memphis, Tenn.*—The Talley-Bates Constr. Co., of Memphis, is stated to have on June 9 secured, by order of the Secy. of War, the contract for placing approximately 1,800,000 cu. yds. of earthwork on the levee lines in the Upper St. Francis, the Lower St. Francis and the White River levee districts, in the States of Mo., Ark. and La. According to the terms of the contract, the work is to be commenced not later than July 1, 1905, and is to be completed not later than Jan. 1, 1906; contract price reported to be about $309,288.

**Galveston, Tex.*—The contract for the revetment to be constructed by the U. S. Government down 53d St., from the western end of the seawall in front of the Ft. Crockett reservation to the intersection of 53d St. and Ave. U, is stated to have been awarded on June 5 to I. Heffron & Sons, 2810 Market St.

Newport News, Va.—The only bid received June 9 by the Superv. Arch., Treas. Dept., Washington, D. C., for installation of pumping machinery for hydraulic lift in U. S. Custom House and Post Office, was submitted by the Maryland Elevator & Machine Co., Baltimore, Md., for $2,590.

**Ashland, Wis.*—Geo. Wieland, of Duluth, Minn., is stated to have secured the contract for repairs and improvements to the pier at Ashland, to consist of the furnishing and placing of 53,000 tons of rip rap (bids opened May 13).

**Port Wing, Wis.*—Whitney Bros. Co., of Superior, are stated to have secured the contract for building a government pier at Port Wing (bids opened June 5) for $14,100.

Cornwall Centre, Ont.—Bids will be received by John Mullin, Township Clk., Cornwall Centre, on June 27. for the construction of that part of the River Aux Raisin within the township of Cornwall; also separate bids for the construction of bridges required by the said drainage scheme in the Township of Cornwall. Contractors are also requested to submit bids for the whole work, both in Township of Osnabruck and Cornwall; probable cost of work, $45,000.

Port Arthur, Ont.—J. McTerque, Town Clk., writes that the Town Council proposes constructing a dam on Current River.

PROPOSALS OPEN

For Proposals see pages 56, 58, 59, 60, 61, AND 62

WATER WORKS.

Bids Close.		See Eng. Record.
Jun. 20.	Pump, etc., Vidalia, La..............	Jun. 17
Jun. 20.	Engine, etc., Cleveland, O..........	Jun. 17
Jun. 20.	Filtration system, Bellaire, O........	Jun. 17
Jun. 22.	Alma, Neb. Adv. May 27 to June 10..	May 27
Jun. 22.	Liberty, Mo. .... Adv. Jun. 10, 17.	Jun. 10
Jun. 22.	Manistique, Mich. .... Adv. Jun. 10.	Jun. 10
Jun. 22.	System, Cookeville, Tenn........... Adv. Jun. 10.	Jun. 10
Jun. 22.	Valves, etc., New York, N. Y........	Jun. 17
Jun. 23.	Pipe, etc., Winnipeg, Man. .... Adv. Jun. 3 to 17.	Jun. 3
Jun. 24.	**Reservoir, Guantanamo, Cuba.........**	**May 20**
Jun. 24.	Pipe, etc., Norfolk, Va............. Adv. Jun. 10, 17.	Jun. 10
Jun. 26.	Taking down stand pipe, etc., Sherman, Tex. Adv. Jun. 3	Jun. 3
Jun. 26.	System, Highlands, N. J............. Adv. Jun. 10, 17.	Jun. 10
Jun. 26.	Tank, etc., Meaford, Ont.	Jun. 17
Jun. 27.	Pipe laying, Cincinnati, O..........	Jun. 3
Jun. 28.	**Irrig. work, Billings, Mont. ....** **Adv. May 6 to June 10.**	**May 6**
Jun. 28.	**Pump sta., etc., Huntley, Mont.......** **Adv. May 6 to June 10.**	**May 6**

**Items marked thus give the names of parties awarded contracts.*

Jun. 28. Pipe, etc., Buffalo, N. Y.............Jun. 17
Jun. 29. Filtration plant improv., Wash., D. C..Jun. 17
Jun. 30. Pumps, etc., Toledo, O..............Jun. 3
Adv. Jun. 3 to 17.
Jun. 30. Water wks., Mt. Olive, Ill..........Jun. 17
Adv. Jun. 17.
Jun. 30. Pipe, Kansas City, Mo..............Jun. 17
Jun. —. **Prescott, Wash.** ....**Apr. 1**
Jun. —. Alma, Wash. ....Apr. 22
Jun. —. Pumps, etc., **Richland, Ga.** ....Apr. 22
Jun. —. Pipe, etc., **Thibodaux, La.** ....Apr. 22
Jul. 1. Water works, Winside, Neb. ....Jun. 3
Jul. 1. Cottage Grove, Ore..................Jun. 10
Jul. 3. Reservoir, Winnipeg, Man...........Jun. 3
Adv. Jun. 3 to 17.
Jul. 10. Pipe, etc., Panama.................Jun. 17
Jul. 17. Bishopville, S. C...................Jun. 3
Adv. Jun. 3 to 17.
Jul. 17. Valves, pipe, etc., Panama..........Jun. 17
Adv. Jun. 17.
Jul. 18. System, Wahpeton, N. D............Jun. 17
Jul. —. Water wks., Morehead City, N. C......Jun. 17

SEWERAGE AND SEWAGE DISPOSAL.

Jun. 20. Chicago, Ill. ....May 27
Adv. May 27 to Jun. 17.
Jun. 20. Waterbury, Conn. ....May 20
Adv. May 20 to Jun. 10.
Jun. 20. Chicago, Ill. ....Jun. 10
Jun. 20. New York, N. Y.....................Jun. 10
Jun. 20. Trenton, N. J. ....Jun. 17
Jun. 20. Torrington, Conn. ....Jun. 17
Jun. 20. East St. Louis, Ill. ....Jun. 17
Jun. 21. Greensburg, Ind. ....Jun. 3
Jun. 21. Butte, Mont. ....Jun. 17
Jun. 22. Janesville, Wis. ....Jun. 10
Jun. 22. Manistique, Mich. ....Jun. 10
Adv. Jun. 10.
Jun. 22. Galveston, Tex.....................Jun. 3
Adv. June 3, 10.
Jun. 22. Newark, N. J. ....Jun. 17
Adv. June 17.
Jun. 22. Waco, Tex. ....Jun. 17
Jun. 22. Scotia, N. Y. ....Jun 17
Jun. 22. St. Paul, Minn. ....Jun. 17
Jun. 22. Long Island City, L. I., N. Y......Jun. 17
Jun. 23. Ft. Walla Walla, Wash..............Jun. 17
Jun. 23. Cincinnati, O. ....Jun. 17
Jun. 24. Norfolk, Va. ....Jun. 10
Adv. Jun. 10, 17.
Jun. 24. Ravenna, O. ....Jun. 10
Jun. 24. Seattle, Wash. ....Jun. 17
Jun. 26. London, O. ....Jun. 10
Jun. 27. Cleveland Heights, O...............Jun. 3
Jun. 27. Greensburg, Ind. ....Jun. 10
Adv. Jun. 10, 17.
Jun. 27. Binghamton, N. Y. ....Jun. 17
Jun. 28. Quitman, Ga. ....Jun. 17
Adv. Jun. 17.
Jun. 28. Brooklyn, N. Y. ....Jun. 17
Jun. 29. South Milwaukee, Wis. ....Jun. 17*
Jun. —. Sacramento, Cal. ....May 13
Jul. 1. Morgantown, N. C. ....Jun. 3
Jul. 1. St. Charles, Mo. ....Jun. 17
Jul. 1. Bridgeport, Conn. ....Jun. 17
Adv. Jun. 17.
Jul. 3. **Brainerd, Minn.** ....Jun. 10
Jul. 3. Gettysburg, Pa. ....Jun. 17
Adv. Jun. 17.
Jul. 5. Cincinnati, O. ....Jun. 17
Jul. 7. Abilene, Kan. ....Jun. 17
Jul. 18. Wahpeton, N. D. ....Jun. 17
Jul. 21. Utica, N. Y. ....Jun. 17
Adv. Jun. 17.
Aug. 1. Toronto, Ont. ....Jun. 17

BRIDGES.

Jun. 20. **Cadillac, Mich.** ....May 13
Adv. May 13 to 27.
Jun. 20. Fargo, N. D. ....Jun. 3
Jun. 20. Columbus City, Ind..................Jun. 10
Jun. 20. O'Neil, Neb. ....Jun. 3
Jun. 20. Tacoma, Wash. ....Jun. 3
Jun. 20. New York, N. Y.....................Jun. 10
Jun. 20. Hartford City, Ind. ....Jun. 17
Jun. 20. Roblin, Ont. ....Jun. 17
Jun. 21. North Adams, Mass..................Jun. 17
Adv. June 21.
Jun. 22. Paterson, N. J. ....Jun. 10
Jun. 22. Columbus, O. ....Jun. 17
Jun. 23. Brookholm, Ont. ....Jun. 17
Jun. 23. Reading, Pa. ....Jun. 17
Jun. 24. Ada, Mich. ....Jun. 3
Adv. June 3, 10.
Jun. 24. Moline, Ill. ....Jun. 10
Jun. 24. Chicago, Ill. ....Jun. 17
Jun. 24. Cleveland, O. ....Jun. 17
Jun. 26. Muir, Mich. ....Jun. 10
Jun. 26. Thamesford, Ont. ....Jun. 17
Jun. 27. Emrichsville, Ind.... ....Jun. 17
Jun. 28. Tiverton, R. I. ....Jun. 3
Adv. Jun. 3 to 17.
Jul. 3. Natchitoches, La. ....Jun. 10
Jul. 5. Tillamook, Ore. ....May 27
Jul. 5. Vale, Ore ....Jun. 3
Jul. 5. Fossil, Ore. ....Jun. 17
Jul. 6. Redding, Cal. ....May 27
Jul. 6. Lawrenceville, Ga. ....Jun. 3
Jul. 7. Baltimore, Md. ....Jun. 17
Jul. 8. Portland, Me. ....Jun. 17
Adv. Jun. 17.
Jul. 8. Terre Haute, Ind. ....Jun. 17
Jul. 11. Castlewood, S. D. ....Jun. 10
Jul. 11. Wabasha, Minn. ....Jun. 17

PAVING AND ROADMAKING.

Jun. 20. Bedford, Ind. ....Jun. 10
Jun. 20. New York, N. Y.....................Jun. 10
Jun. 20. Napoleon, O. ....Jun. 10
Jun. 20. Bellevue, Pa. ....Jun. 17
Jun. 20. Washington, D. C. ....Jun. 17
Jun. 20. East St. Louis, Ill................Jun. 17
Jun. 21. Central City, W. Va................Jun. 3
Adv. Jun. 3 to 17.
Jun. 21. Indianapolis, Ind. ....Jun. 17
Jun. 21. West Hoboken, N. J. ....Jun. 17
Jun. 22. Delaware, O. ....Jun. 3
Jun. 22. East Liverpool, O. ....Jun. 10
Jun. 22. Concord, N. H. ....Jun. 10
Jun. 23. Steubenville, O. ....Jun. 3
Jun. 23. Glendale, O. ....Jun. 3
Jun. 23. Ft. Totten, N. Y. ....Jun. 17
Adv. Jun. 17.
Jun. 24. Seattle, Wash. ....Jun. 17
Jun. 24. Belleville, Ill. ....Jun. 17
Jun. 24. Louisville, Ky. ....Jun. 17
Jun. 26. Wellsville, N. Y....................Jun. 17
Adv. Jun. 17.
Jun. 26. Cincinnati, O. ....Jun. 3
Jun. 26. Newark, N. Y. ....Jun. 17
Jun. 26. Long Island City, L. I., N. Y.......Jun. 17
Jun. 27. Boise, Idaho ....Jun. 10
Jun. 27. Pottstown, Pa. ....Jun. 17
Adv. Jun. 17.
Jun. 27. New Brighton, S. I., N. Y..........Jun. 17
Jun. 28. Cincinnati, O. ....Jun. 10
Jun. 28. Portsmouth, O. ....Jun. 10
Jun. 28. New Brunswick, N. J................Jun. 10
Jun. 29. New York, N. Y.....................Jun. 17
Jun. 29. New York, N. Y.....................Jun. 17
Jun. —. **Council Bluffs, Ia.** ....**May 20**
Jul. 1. Cleveland, O. ....Jun. 10
Jul. 1. Trinidad, Col. ....Jun. 17
Adv. June 17.
Jul. 1. Helena, Ark. ....Jun. 17
Jul. 3. Greencastle, Ind. ....Jun. 17
Jul. 5. Cincinnati, O. ....Jun. 17
Jul. 5. Emlenton, Pa. ....Jun. 17
Adv. Jun. 17.
Jul. 5. Gravel road, Mt. Holly, N. J.........Jun. 17
Adv. Jun. 17.
Jul. 5. Stone road, Mt. Holly, N. J.........Jun. 17
Adv. Jun. 17.
Jul. 7. Vincennes, Ind. ....Jun. 17
Jul. 8. Beloit, Wis. ....Jun. 17
Jul. 11. Telford road, Mt. Holly, N. J......Jun. 17
Adv. Jun. 17.
Aug. 1. Belvidere, Ill. ....May 20

POWER, GAS AND ELECTRICITY.

Jun. 20. Dunn, N. C. ....Jun. 3
Jun. 20. Washington, D. C. ....Jun. 3
Jun. 20. Portland, Me. ....Jun. 10
Adv. Jun. 10, 17.
Jun. 20. Ft. Crook, Neb. ....Jun. 17
Jun. 22. Alma, Neb. Adv. May 27 to Jun. 10..May 27
Jun. 22. Cookeville, Tenn. ....Jun. 10
Adv. Jun. 10.
Jun. 26. Ft. Bragg, Cal. ....Jun. 10
Jun. 26. Highlands, N. J....................Jun. 10
Adv. Jun. 10, 17.
Jun. 26. New York, N. Y.....................Jun. 17
Jun. 26. Buffalo, N. Y. ....Jun. 17
Jun. 26. Elkton, S. D. ....Jun. 17
Jun. 27. Washington, D. C. ....Jun. 17
Jul. 3. Ukiah, Cal. ....Jun. 10
Jul. 7. Durant, Miss. ....Jun. 3
Jul. 11. Lincoln, Neb. ....Jun. 17
Adv. Jun. 17.
Jul. 15. Pensacola, Fla. ....Jun. 17
Jul. 15. Kings Mountain, N. C...............Jun. 17
Jul —. Morehead City, N. C...................Jun. 17

BUILDINGS.

Jun. 20. P. O. Bldg., Colorado Springs, Colo..May 20
Adv. May 13, 20.
Jun. 20. School, Port Arthur, Tex. ....May 27
Jun. 20. Pub. Bldgs., Chicago, Ill.............Jun. 10
Jun. 20. Repairs to hosp., Ft. Rodman, Mass., Jun. 10
Jun. 20. School, Newark, N. J.................Jun. 10
Jun. 20. Pub. bldg., Sheboygan, Mich.........Jun. 10
Jun. 20. Pub. Bldg., London, Ont............Jun. 10
Jun. 20. Pub. bldg. equip., New York, N. Y., Jun. 10
Jun. 20. Post bldgs., Ft. Monroe, Va..........Jun. 10
Jun. 20. Post. Hosp., Ft. Wood, N. Y. H.,
N. Y. Adv. Jun. 10, 17..............Jun. 10
Jun. 21. **P. O. Bldg., Winston, N. C.** ....**May 20**
Jun. 21. Htg., etc., Pub. Bldg., Ft. Bank, Mass., Jun. 10
Jun. 21. Vent. and htg. school, Waldron, Ind..Jun. 10
Jun. 21. Jail, Baltimore, Md. ....Jun. 10
Jun. 21. School, Rhinelander, Minn...........Jun. 17
Jun. 21. Pub. build., Chicago, Ill............Jun. 17
Jun. 21. Home, Wilmar, Minn.................Jun. 17
Jun. 22. School, Jersey City, N. J.............Jun. 10
Jun. 23. P. O. bldg., Vancouver, B. C. ....May 27
Jun. 23. Hospital, Dayton, O.................Jun. 3
Jun. 23. School, Milwaukee, Wis. ....Jun. 10
Jun. 23. Alter. to hospital, New York, N. Y., Jun. 17
Jun. 23. Boilers in P. O., Louisville, Ky.....Jun. 17
Jun. 24. School, Bedford, O. ....Jun. 3
Jun. 24. School, Arcadia, Fla. ....Jun. 17
Jun. 24. Church, Huntington, Ind. ....Jun. 17
Jun. 24. Pub. bldg., Ft. Myer, Va...........Jun. 17
Jun. 25. Court House, Lake Village, Ark. ....Jun. 3
Jun. 26. P. O. Bldg., Niagara Falls, N. Y. .....May 27
Jun. 26. School, Poplar, Mont. ....Jun. 3
Jun. 26. School, Des Moines, Ia.............Jun. 3
Jun. 26. Alter. to school, Long Island City,
L. I., N. Y...........................Jun. 10
Jun. 26. Police court, Washington, D. C........Jun. 17
Jun. 26. School, Jefferson, Ia. ....Jun. 17
Jun. 26. School, Madison, Wis. ....Jun. 17
Jun. 26. Schools, New York, N. Y............Jun. 17
Jun. 26. Church, Perham, Minn. ....Jun. 17
Jun. 27. Library, Cincinnati, O..............Jun. 3
Jun. 27. Post-Office, Grand Forks, N. D.......Jun. 10
Jun. 27. Vent. and htg. school, Los Angeles,
Cal. ....Jun. 10
Jun. 27. School, Montclair, N. J..............Jun. 10
Adv. Jun. 10, 17.
Jun. 27. Pub. bldgs., New Brighton, S. I.,
N. Y. ....Jun. 17
Jun. 28. School, Agriculture College, Mich....Jun. 10
Jun. 28. P. O. Bldg., Westchester, Pa. ....May 27
Jun. 28. Htg. court house, Shelbyville, Ind...Jun. 10
Jun. 28. Pub. Bldgs., Binghamton, N. Y......Jun. 10
Jun. 29. Schools, etc., Indianapolis, Ind......Jun. 17
Jun. 29. School, Vandalia, Mo. ....Jun. 17
Jun. 29. Hospital, Wash., D. C., Adv. Jun. 3 to
17 ....Jun. 3
Jun. 29. Exter. work, Senate Bldg., Washington, D. C. ....Jun. 10
Jun. 29. Shelters, Brooklyn, N. Y............Jun. 17
Jun. 30. Lodge, Diamond, Ind. ....Jun. 3
Jun. 30. City Hall, etc., Ida Grove, Ia........Jun. 17
Jun. 30. Light Sta., Portland, Ore............Jun. 17
Jun. —. **School plans, Stillwater, Okla. Ter.**....**May 20**
Jul. 1. Bus. bldg., Atlantic City, N. J........Jun. 10
Jul. 1. Pub. Bldg., Washington, D. C........May 27
Adv. May 27 to Jun. 17.
Jul. 1. **Pub. Bldg., Baltimore, Md.** ....**May 20**
Jul. 1. Court House, Wallace, Idaho........Jun. 3
July 1. Bus. bldgs., Liberty, Ia..............Jun. 17
Jul. 3. School, East Liverpool, O............Jun. 17
Jul. 3. School, Albany, N. Y................Jun. 17
Jul. 5. Pub. Bldg. plans, Springfield, Mass..Jun. 10
Jul. 5. Court House plans, **Montgomery, Ala.May 27**
Jul. 5. Pub. bldgs., National Military Home,
O. ....Jun. 17
Jul. 6. Hospital, Dunlaps, Ia................Jun. 3
Jul. 6. School, Cleveland Heights, O.........Jun. 10
Jul. 7. Metal work, Light Sta., Phila., Pa...Jun. 10
Adv. Jun. 10, 17.
Jul. 10. School, Cleveland, O. ....Jun. 17
Jul. 10. Court house, Wallace, Idaho.........Jun. 17
Jul. 11. Hospital, Goshen, Ind. ....Jun. 10
Jul. 12. Htg. court house, Cambridge, Minn., Jun. 10
Jul. 12. P. O. Bldg., Deadwood, S. D........Jun. 17
Adv. Jun. 17.
Jul. 15. Hotel, Little Rock, Ark. ....Jun. 17
Jul. 18. Schools, Wahpeton, N. D. ....Jun. 17
Jul. 20. Custom House, San Francisco, Cal..Jun. 3
Jul. 22. Hospital, New Orleans, La...........Jun. 17
Jul. 24. P. O. Bldg., Fargo, N. D............Jun. 17
Jul. 30. Court House improv., Leesville, La. ..May 13
Aug. 1. Y. M. C. A. Bldg., Spokane, Wash. ..Apr. 29
Aug. 9. Pub. bldgs., Chicago, Ill............Jun. 17
——— Schools, North Providence, R. I......Jun. 17

MISCELLANEOUS.

Jun. 20. Searchlight outfit, **Washington, D. C..May 20**
Adv. May 20 to Jun. 10.
Jun. 20. Dredging, Wilmington, Del. ....May 27
Adv. May 27 to Jun. 17.
Jun. 20. Dredging, Baltimore, Md. ....May 27
Adv. May 27 to Jun. 17.
Jun. 20. Dredging, Detroit, Mich. ....May 27
Adv. May 27 to Jun. 17.
Jun. 20. Elevator, Washington, D. C. ....May 27
Jun. 20. Levee, Walnut Hill, Ark. ....May 27
Jun. 20. Sea Wall, Ft. Mifflin, Pa. ....Jun. 3
Jun. 20. Stone, etc., Vicksburg, Miss.........Jun. 3
Adv. June 3 to 17.
Jun. 20. Supplies, Washington, D. C..........Jun. 3
Jun. 20. Pier, Cleveland, O. ....Jun. 3
Jun. 20. Supplies, Washington, D. C..........Jun. 3
Jun. 20. Piers, Ft. Rodman, Mass.............Jun. 10
Jun. 20. Elevator, New York, N. Y............Jun. 10
Jun. 20. Levee, Vicksburg, Miss. ....Jun. 10
Jun. 20. Park work, Cleveland, O.............Jun. 17
Jun. 21. Light house supplies, Tompkinsville,
S. I., N. Y. Adv. May 27 to Jun. 17..May 27
Jun. 21. Dredging, Baltimore, Md. ....May 27
Adv. May 27 to Jun. 17.
Jun. 21. Levee work, Hopefield, Ark. ....May 27
Adv. May 13, 27.
Jun. 21. Dredging, Wilmington, Del. ....May 27
Jun. 22. Dredging, Detroit, Mich. ....May 27
Adv. May 27 to Jun. 17.
Jun. 22. Sea Wall, Governor's Island, N. Y. H. May 27
Adv. May 27 to Jun. 17.
Jun. 22. Extension of Jetty, Portland, Ore....Jun. 3
Jun. 22. Renewing steam pipes, National Soldiers' Home, Va.....................Jun. 3
Jun. 22. Supplies, New York, N. Y............Jun. 17
Jun. 24. El. Ry. franchise, Hollister, Cal. .....May 20
Jun. 24. Elevator, Charleston, S. C..........Jun. 3
Jun. 24. Grade work, etc., St. Ry., Bluffton,
Ind. ....Jun. 17
Adv. Jun. 17.
Jun. 26. Telephone system, Belle Fourche, S. D. May 27
Adv. May 27 to Jun. 17.
Jun. 26. Dredging, Boston, Mass. (2 prop.) ...May 27
Adv. May 27 to Jun. 17.
Jun. 26. Dredging, Wilmington, Del. ....Jun. 3
Adv. June 3 to 17.
Jun. 26. Dike, etc., Duluth, Minn............Jun. 3
Adv. June 3 to 17.
Jun. 26. Dredging, Boston, Mass.............Jun. 3
Jun. 26. Dredging, Charleston, S. C..........Jun. 3
Adv. June 3 to 17.
Jun. 26. Pier, New York, N. Y................Jun. 17
Jun. 27. Dredging, Boston, Mass. Adv. Jun. 3
to 17 ....Jun. 3
Jun. 27. Dredging, Duluth, Minn............Jun. 3
Adv. June 3 to 17.
Jun. 27. Supplies, Washington, D. C..........Jun. 10
Jun. 27. Supplies, Washington, D. C..........Jun. 17
Jun. 27. Drainage works, Cornwall Centre,
Ont. ....Jun. 17
Jun. 28. Jetty Work, Galveston, Tex. ....Jun. 3
Adv. June 3 to 17.
Jun. 29. Dredging, Prophetstown, Ill. ....Jun. 10
Jun. 29. Wall, etc., New York, N. Y..........Jun. 17
Jun. 30. Dredging, York, Me.................Jun. 3
Adv. Jun. 3 to 17.
Jun. 30. Dredging, Savannah, Ga.............Jun. 3
Adv. Jun. 3 to 17.
Jun. 30. Cement, Cincinnati, O...............Jun. 10
Jun. —. Subway, Memphis, Tenn. ....May 13
Jul 1. **Municipal St. Ry. system, Chicago, Ill.Apr. 15**
Jul. 1. Dredge, Chicago, Ill. ....Jun. 3
Jul. 1. Dredging, Jacksonville, Fla. ....Jun. 3
Adv. Jun. 3 to 17.
Jul. 1. Dredging, Montgomery, Ala...........Jun. 10
Adv. Jun. 10 to 17.
Jul. 1. Cables, Philadelphia, Pa..............Jun. 17
Jul. 3. Dredging, etc., Norfolk, Va..........Jun. 10
Adv. Jun. 10
Jul. 3. Dam, etc., Mobile, Ala..............Jun. 10
Adv. Jun. 3 to 17.
Jul. 3. Bear-trap gates, Pittsburg, Pa........Jun. 3
Adv. Jun. 3 to 17.
Jul. 5. Dredging, Baltimore, Md.............Jun. 10
Adv. Jun. 3 to 17.
Jul. 5. Rock, etc., New Orleans, La..........Jun. 17
Jul. 6. Jetty work, Wilmington, Del.........Jun. 10
Adv. Jun. 10 to 17.
Jul. 6. Dredging, Wilmington, Del...........Jun. 17
Jul. 7. Conduit, Chicago, Ill. ....Jun. 17
Adv. Jun. 17.
Jul. 7. El. Ry. work, Baltimore, Md........Jun. 17
Jul. 8. Jetty work, Block Island, R. I......Jun. 17
Adv. June 17.
Jul. 8. Dredging, Block Island, R. I........Jun. 17
Adv. Jun. 17.
Jul. 10. Boiler, Wilmington, N. C. ....Jun. 17
Adv. Jun. 17.
Jul. 12. Dredging, Portland, Me..............Jun. 17
Adv. Jun. 10 to 17.
Jul. 12. Dredging, etc., Jacksonville, Fla......Jun. 17
Adv. Jun. 17.
Jul. 14. Dredging, Boston, Mass..............Jun. 17
Jul. 14. Dredging, Mobile, Ala...............Jun. 17
Adv. Jun. 17.
Jul. 15. Storage plant, etc., Pensacola, Fla....Jun. 17
Aug. 9. Dock, Chicago, Ill. ....Jun. 17
Aug. 26. Coal plant, Olongapo, P. I. ....May 6
Sep. 1. Steel and iron, Sydney, N. S. Wales..Apr. 8
Adv. Apr. 8, 22; May 6, 20; Jun. 3, 17.
Nov. 1. R. R. work, Manila, P. I.............Jun. 17
Adv. Apr. 29 to Jun 17............Apr. 29
Apr. 2, '06. Harbor Work, Valparaiso, Chili.